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The Saskatchewan All Risk Crop Insurance Program
An Evaluation of Land Use, Technology Adoption and Participation

Conducted by W. P. Weisensel
A. Schmitz and W. H. Furtan

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THE SASKATCHEWAN ALL RISK CROP INSURANCE PROGRAM: AN EVALUATION OF LAND USE, TECHNOLOGY ADOPTION AND PARTICIPATION

by

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EXECUTIVE SUMMARY

Abstract

There is a growing concern that the Saskatchewan Crop Insurance program inhibits soil conservation and slows the adoption technology. Differences in regional participation rates are also a concern. This report examines and explains; (1) the influence of crop insurance on management decisions and (2) differences in participation rates in various regions of the province.

The major conclusions are as follows: (1) Many farmers, who participate in crop insurance, manage their farms differently than if the program did not exist. (2) There are differences in the regional benefits of the crop insurance program, which explain differences in the rates of participation. (3) Crop insurance does not influence land use significantly.

Summary

The Saskatchewan All Risk Crop Insurance program is an important stabilization policy to grain producers. Its importance is indicated by the fact that 75 percent of the farmers in the province currently participate in the program. However, there has been a growing concern in recent years that farm land use has been detrimental to the preservation of Saskatchewan soils and crop insurance is at the center of this concern. In addition, there has also been concern regarding the discrepancy in participation rates between different production regions in the province. Therefore, the purpose of this report was to; (1) examine the causal relationships between crop insurance and farm management decisions, since it is these decisions which ultimately affect land use and (2) examine and explain differences in participation in various regions of the province.

A conceptual model was developed which explains how a general crop insurance program affects farm management decisions. In particular, it explains the decision to participate as well as the traditional principle-agent problems of moral hazard (changing farm practices because of crop insurance) and adverse selection (participators tend to have slightly lower yields).

In order to test many of the hypotheses of the conceptual model, survey data was collected from approximately 250 producers in four separate regions of the province. Both participators and non-participators were contacted. Consequently, the data was suitable for the comparison of the socio-economic variables as well as the farm practices of the two groups. Finally, by comparing the yield distributions of producers in the different areas we were able to determine the net benefit of crop

insurance in the four regions surveyed.

The first major conclusion of this study deals with the categorization of participants. In the past, it has generally been recognized that there are two groups of participators, namely; i) participators, and ii) non-participators. This study discovers and documents a third group which we call selective participators. Selective participators are those individuals who participate only when they see a potential benefit to participating.

The second major conclusion of this study is that moral hazard exists in the participating group. In other words, farmers who participate in the crop insurance program tend to manage their farms somewhat differently than if the program did not exist. Producers admitted that risk splitting was the major reason for the change in behaviour.

The third major conclusion of the study addresses the regional benefits of the crop insurance program. Based on the four regions surveyed as part of the project, it appears that Melfort and MooseJaw have significantly less insurance value than does the Chaplin Central Butte region for spring wheat. Finally, an expansion of the analysis to other areas of the province seems to indicate that the value of the crop insurance program decreases as one moves from south western grain producing areas to north eastern grain producing areas.

The fourth conclusion deals with the effect of crop insurance on land use in Saskatchewan. Based on the empirical analysis comparing participators and non-participators, we were unable to find any statistical relationship between crop insurance and land use. However, this is not surprising when one takes into account the myriad of government programs which likely mask the affects of crop insurance. However, we cannot conclude that crop insurance has not resulted in the cultivation of marginal land since it would be difficult to find such a relationship in a one shot survey. Nonetheless, we have shown that crop insurance does result in substantial ex-ante subsidies for a substantial number of producers in each of the four areas. However, we also show that these ex-ante subsidies tend to be greatest in those areas where there tends to be the greatest amount of marginal land. Therefore, rational expectations suggest that crop insurance would affect land use where the margin of profitability between pasture and grain land is close.

The most common comments of producers during the survey process were as follows. (1) Program abuse is a problem and more should be done to discourage it. Many producers pointed out that abuse of this nature is unfair to the average participator. (2) Many producers maintain that the levels of coverage within a risk area do not reflect differences in land quality. Producers argued that yield coverage had an upward bias on marginal land and a downward bias on top quality land. (3) Many producers favored the introduction of income insurance to replace crop insurance, while others felt that crop insurance should be modified to be more reflective of the cost of production in an area.

Some of the major recommendations of the study are listed below. (1) Premium rates and coverage should be re-examined so that regional biases in the crop insurance program are eliminated. (2) Premium rate structures for fallow and stubble crop production should be adjusted to reflect the differences in risk associated with each. (3) Individualized coverage based on individual yields is necessary to reduce the problems of adverse selection and moral hazard, but this coverage should not treat different crops separately. Dividing a farm by the number of crops grown provides incentives to farm differently than if crop insurance did not exist. (4) Finally, additional analysis should be done from a farm management perspective to determine the costs and benefits of a producer who frequently practices moral hazard.

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CHAPTER I

INTRODUCTION

1.1 Introduction to the Problem

The most important factor which separates agriculture from other production sectors in any economy is the degree to which agriculture relies on the randomness of nature. Evidence of this randomness is provided in Table 1.1 which illustrates the variability of crop yields in Saskatchewan by crop district for the period of 1972 to 1987.[1] As a response to this characteristic, many studies have examined the desirability of agricultural policies which tend to stabilize farm incomes in an inherently risky environment (see; Stiglitz and Newberry 1985; Hazell et al. 1986). On the production side, one program which is commonly examined and implemented is all risk crop insurance.

In this study, we are concerned with how the Saskatchewan All Risk Crop Insurance program has addressed the risk of agricultural production. The severe drought of the 1988-89 crop year has raised the awareness of public policy makers regarding the effectiveness of crop insurance as an agricultural stabilization tool. In particular, policy makers are interested in revamping the overall program so that ad hoc drought assistant payments, like the one announced for the 1988/89 crop year, are no longer necessary (Agriculture Canada, 1989). In addition, the recent federal budget demands that the cost of crop insurance be shared more equally by federal and provincial governments.[2] Finally, government subsidization of crop insurance will undoubtedly be an important factor at the General Agreement on Tariffs and Trade (GATT). Consequently, since this study examines the microeconomic implications of crop insurance, it may have some bearing on these negotiations.

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[1] Note that crop districts 3, 4, and 5 have greater variability in yields than in the other districts. Finally, the variability of crop district averages will be much less than individual farm yields.

Table 1.1: Spring Wheat Yields by Crop District (1972-1987)

CROP DISTRICT YEAR	1	2	3	4	5	6	7	8	9
1972	604	656	611	552	699	611	661	758	605
1973	695	725	557	444	758	656	676	737	716
1974	600	594	507	564	553	570	683	629	683
1975	648	607	680	670	714	673	774	756	766
1976	673	833	487	716	878	856	893	941	888
1977	827	882	778	547	838	808	742	882	800
1978	886	854	759	628	872	772	747	877	762
1979	495	566	596	669	428	587	781	616	696
1980	571	495	602	641	618	556	721	761	785
1981	729	698	658	695	938	705	792	765	744
1982	709	805	860	777	776	893	947	851	964
1983	623	670	681	762	713	793	865	712	791
1984	508	495	443	419	737	544	621	766	747
1985	673	582	268	248	937	745	640	1025	839
1986	940	996	786	784	830	834	1005	732	841
1987	773	768	750	638	776	784	767	726	777

Source: Agricultural Statistics for Saskatchewan (1981 and 1987).

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[2] In 1989, the federal government paid 50 percent of the actuarial premium rate while the producer paid the remainder. The province of Saskatchewan paid the administration cost of the program. In 1990, this has changed. The producer's contribution remains the same and the provincial and federal governments share the remaining premium and administration costs.

In general, the benefits of crop insurance appear to be substantial, for producers and perhaps the overall economy.[3] However, like most policy programs, crop insurance is not free of criticism. In the following paragraphs we discuss some of the major criticisms of crop insurance as it relates to agricultural production in Saskatchewan.

First, many contend that crop insurance policy is designed to promote grain production without concern for the environment. One of the main criticisms of Soil Conservation Canada is that subsidized crop insurance results in the cultivation of highly erodible marginal lands. In addition, they assert that crop insurance distorts the decision to extend cropping rotations because its yield guarantees favour summerfallow crop production over stubble crop production.

A second argument that has received substantial attention is the statement that crop insurance reduces the incentive to diversify farm operations. Before the inception of crop insurance, farmers in Saskatchewan were forced to seek other enterprises like livestock or new technology to enhance and diversify their agricultural portfolio. Many believe that crop insurance has reduced the need to seek new methods and enterprises to reduce risk because it pools risks across individuals and over time.

The discrepancy between participation rates of northern and southern farmers is also a serious concern (Bristol, 1986). Many maintain that the program is biased to southern farmers since a larger percentage of southern farmers participate in the program.

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[3] From an economic perspective, crop insurance is a preferred policy tool if social benefits (SB) from the program are greater than social costs (SC) given that all individuals are weighted equally. However, crop insurance may be implemented for cases when SC > SB because one group in society is given more weight than another group.

Finally, many producers contend that crop insurance provides incentives to manage poorly since producers are not penalized for this behaviour. Therefore, they maintain that the two classic problems (moral hazard and adverse selection) of principal agent relations in an insurance contract are significant in the Saskatchewan crop insurance program.

Moral hazard arises because producers are insured for the possibility that the worst will happen. Consequently, they have little incentive as managers to try to avoid such an outcome. Therefore, incentives and insurance are inversely related. As the level of insurance increases (i.e., the risk to the producer is lowered), it can be argued that the incentive to maintain high level management is reduced. Therefore, in order to reduce the costs attributable to moral hazard, insurance organizations must closely monitor their clientele. In either case, the cost of insurance is increased for all.

Adverse selection is a problem with insurance programs since there must be some incentive for the farmer to join (i.e., the benefits must be greater than the costs). The problem of adverse selection arises when some farmers do not perceive a net benefit in participating in the program while others do. In these cases, a crop insurance program based on the average yields for a region will not be actuarial sound since only the lower yield producers will participate.

Since crop insurance in Saskatchewan is already subsidized many of the above problems do not necessarily affect the actuarial soundness of the program. However, they do have important implications regarding the efficient and equitable use of government funds. One of the purposes of this study is to determine the importance of these problems in both a theoretical and empirical context.

1.2 Objectives

Crop Insurance is an important stabilization policy. Its importance is indicated by the fact that greater than 75 percent of producers in the province currently participate in the program. However, there has been a growing concern in recent years that farm land use has been detrimental to the preservation of Saskatchewan soils. Crop Insurance, which is unquestionably linked to land use as a major risk management tool, is at the centre of this concern.

The overall objective of this study is to determine the causal relationships between participation in crop insurance and farm management decisions and why producers participate in crop insurance. Specifically, it analyzes and explains:

(1) how participation in crop insurance affects land use and soil conservation in the province of Saskatchewan;

(2) the impact and importance of participation in crop insurance as a risk management tool for Saskatchewan grain producers;

(3) the influence that participation in crop insurance has had on technology adoption in Saskatchewan agriculture; and finally

(4) why an individual producer participates or does not participate in the program.

The above objectives emphasize the importance of understanding the causal relationship between crop insurance and the economic decisions the producer makes. This is crucial to the improvement of the current program.

To meet the above objectives, we construct an economic model to analyze the above relationships. In addition, we collect actual on farm data to determine how crop insurance has influenced land use and technology adoption. Finally, we propose alternative solutions for improving soil conservation and other farm management decisions through crop insurance.

1.3 Purpose of Agricultural Insurance

Hazell et al. (1986) point out three reasons why policy makers should be interested in reducing the riskiness of agriculture. (1) Instability of farm incomes may present substantial welfare problems for rural people. For instance, without stabilization, producers may be forced to sell capital equipment to meet other obligations in low income years.[4] (2) If agricultural producers are risk averse, as previous research suggests (Binswanger 1980; Hazell 1982), then returns to national resources may be reduced, especially since there are likely to be smaller supplies of riskier agricultural commodities.[5] (3) Finally, they point out that when risks are severe, there is a much higher likelihood of loan default. This is a potential problem since one would expect that lenders would charge higher rates of interest to entrepreneurs in riskier sectors.

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[4] Since major droughts tend to occur in relatively large regions, massive sell offs of capital equipment to meet financial obligations could result in substantially reduced asset prices. Fluctuations in asset prices due to this type of economic activity affects all producers in how they deal with their creditors.

[5] Based on the equilibrium suggested by the capital asset pricing model, one would expect that riskier ventures would have higher expected returns.

Therefore, the general purpose of crop insurance is to share the risk of agricultural production so that the risk faced by the individual producer is reduced. Traditionally, this risk sharing is performed in three ways. First, part of the risk is transferred to a party which is not directly involved in agriculture. This party is usually the general population who takes on part of the risk through government participation in the crop insurance scheme. Second, crop insurance schemes tend to pool the risks of crop failure across large regions so that it can take advantage of the offsetting affects of different areas in the same region. In this way, producers who contribute to the crop insurance program are insuring each other and not just themselves. Third, the risks can be spread across time so that good years can subsidize bad years. This is traditionally done by maintaining some type of crop insurance fund.

Hazell et al. (1986) point out that the general objectives of crop insurance are to: (1) Stabilize farm incomes to increase producer welfare. (2) Make more efficient use of national resources so that national welfare is maximized. Finally, (3) to increase the rate of loan recovery, so that the agricultural sector has the same opportunities for credit as other sectors of the economy.

1.4 Historical Background

The variability of crop yields in prairie agriculture has been recognized as a serious problem for many years. The Prairie Farm Assistance Act of 1939 was one of the first programs to address the issue of low yields due to natural hazards like drought. Its purpose was to establish a minimum program of area yield crop insurance and to provide the administration necessary to distribute relief payments to farmers on the basis of need. However, as the Royal Commission on Agriculture and Rural Life (RCARL, 1956) pointed out, the program suffered from several criticisms. By 1956, the size of payments was considered to be inadequate since they were based on cost of production estimates for 1939. In addition, the area yield concept upon which it was based created large inequities for farmers in the same region. Furthermore, the program failed to relate premiums and coverage to individual and area risks. As a result, the program tended to discriminate against high production and high cost regions.

These criticisms led the RCARL (1956) to recommend that a prairie all risk crop insurance program be implemented on an experimental basis for a number of different risk areas. Interestingly, they proposed that premiums be collected as a proportion of grain marketings.[6] Finally, one of their many recommendations recognized that federal participation was crucial since the liabilities of all-risk crop insurance were beyond the financial bearing ability of any one province.

In response to the RCARL (1956) report and public opinion, the federal and prairie provincial governments drafted the legislation necessary to implement crop insurance. As a result in September of 1960, the federal and provincial governments established the Saskatchewan crop insurance program. The program was modelled after its American counterpart and like the U.S. program, the purpose of the Saskatchewan program was to provide voluntary insurance to producers against losses due to natural hazard.[7] The program provided production guarantees based on the average productivity of a given area. The primary rationale for the program was based on the welfare of agricultural producers and rural communities.

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[6] This was identical to the levy collection system used for the PFAA.

1.5 Legislation

The original program operated within the boundaries outlined by (1) the Canadian Crop Insurance Act, (2) the Saskatchewan Crop Insurance Act, and (3) the agreement between the federal and provincial governments regarding liability and cost breakdown. The Canadian Crop Insurance Act provided capital and loans to provincial programs provided that the plan was actuarial sound, had a minimum of 25 percent participation in any specific risk area, and that the insured coverage did not surpass 60 percent of the average yield for any specific risk area. If these requirements were met, the federal government contributed up to 50 percent of the administration costs, 25 percent of producer premiums and would make loans to the provincial program equivalent to 75 percent of the sum necessary to meet losses (provided that the reserve fund was depleted).

The Saskatchewan Crop Insurance Act was responsible for establishing and administrating the program. It paid all remaining administration costs, paid up to 20 percent of the total premium levied into a disaster reserve fund, established a normal reserve fund and assumed the total liability for the risk of the program.

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[7] It provided protection against unavoidable losses of production due to drought, excessive rain, flood, hail, frost, snow, lightning and grasshoppers. However, it generally excludes such causes which are directly related to management practices (moral hazard).

1.6 Program Operation

In its first operational year (1961), the program received 439 applications from interested producers. The low number of applications in the initial year were attributed to many factors, but the primary one was the limited time period for farmers to make the decision to join the program. Farmers wishing to participate had to make a $0.25/acre cash payment in a short period during the month of January, 3-4 months prior to seeding. As a result, no single risk area had enough applications to meet the 25 percent minimum requirement. Consequently, the Saskatchewan Crop Insurance Board requested and received special permission to run a pilot project program for the first year in 25 areas where farmer interest was most intense. Therefore, only 199 applications were accepted by the Crop Insurance Board in the initial year.

In 1962, changes were made to the original program with the hope that it would increase farmer participation. Down payments for crop insurance were reduced to $0.15 from $0.25 per seeded acre. Farmers who paid their premiums prior to April 15 were given a 3 percent discount. In addition, farmers with cash flow constraints were given greater access to the program with the introduction of premium notes which matured on October 15. Notes paid at maturity had an additional surcharge of 15 percent. Finally, commercial agents were used to solicit and maintain insurance contracts. This helped increase the availability of insurance to local farmers.

Since the initial years when the program was organized and modified, there have been many subsequent changes to the program. Most of these changes have been directed at the level of coverage, premiums, and financing. In the following paragraphs, the most important of these changes will be outlined. Tables 1.2 and 1.3 illustrate how contract numbers, crops contracted, payouts paid and other important statistics to the program have changed over the life of the program.

In 1965, changes were made to the financing of the crop insurance program. It was decided that the federal and provincial governments would share the cost of program administration with each paying 50 percent of the cost. Prior to this change, the federal government provided up to a 50 percent maximum of the administration cost with the provincial government paying the remainder. In addition, the federal government agreed to pay 20 percent of the actuarial premium rate with the farmer picking up the remaining 80 percent. Before this change the federal government guaranteed up to a maximum of 20 percent of the premium coverage.

Finally, effective for the 1965 crop year, the federal and provincial governments agreed upon a method of insurance of the liabilities of crop insurance. Prior to this change the provincial government had refused to insure more than 5,000 contracts in a single year. The primary reason for this reluctance was that the risks were too great to insure more farmers.[8] Consequently, in 1966 there was a substantial increase in the number of contracts insured (Table 1.2).

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[8] Personal discussions with Professor Jake Brown of the Department of Agricultural Economics, University of Saskatchewan. In 1965, he was on the board of directors of the Saskatchewan Crop Insurance Board.

Table 1.2: Summary of Aggregate Crop Insurance by Year (1961-1987).

Year	Farm Numbers Insured	Revenue Earned by Source		Indemnities Paid Numbers and Amount		Loss to Revenue Annual and Accumulated	
		Total	Govt. of Can.	Number	Amount	Annual	Accumulated
1961	194	31,586	6,275	169	129,669	4.11	4.11
1962	1,337	224,611	43,161	147	61,651	0.27	0.75
1963	2,235	372,180	69,657	38	9,285	0.02	0.32
1964	2,357	370,342	69,144	240	137,926	0.37	0.34
1965	3,172	402,388	74,021	301	123,304	0.31	0.33
1966	6,989	1,010,907	184,907	161	107,978	0.11	0.24
1967	8,211	1,377,099	313,499	887	497,118	0.36	0.28
1968	12,343	2,476,308	559,921	1,683	1,607,853	0.65	0.43
1969	11,637	2,007,405	427,616	553	385,787	0.19	0.37
1970	9,083	1,050,640	195,667	213	104,338	0.10	0.34
1971	7,890	1,349,366	259,933	206	142,930	0.11	0.31
1972	11,844	2,773,108	597,050	1,654	1,262,763	0.46	0.34
1973	23,909	14,341,387	6,688,320	8,484	7,730,305	0.54	0.44
1974	31,411	30,597,743	14,158,291	23,505	32,898,379	1.08	0.77
1975	38,209	40,960,627	19,985,427	24,444	28,392,087	0.69	0.74
1976	39,143	53,785,749	26,160,037	15,092	22,401,840	0.42	0.63
1977	47,156	72,441,650	34,446,565	21,915	36,862,943	0.51	0.59
1978	43,032	72,720,436	33,553,882	17,389	29,419,884	0.41	0.54
1979	40,154	76,378,011	34,426,225	39,050	103,835,041	1.34	0.71
1980	42,850	88,489,170	42,202,922	35,907	135,708,452	1.53	0.87
1981	46,259	108,487,827	52,871,324	29,167	92,280,986	0.85	0.86
1982	44,469	115,954,971	56,364,777	23,967	74,157,729	0.64	0.83
1983	43,000	114,633,673	55,620,789	26,804	105,243,197	0.92	0.84
1984	43,443	128,028,555	63,356,964	51,853	259,864,151	2.03	1.00
1985	46,894	158,212,616	77,211,976	57,693	377,180,151	2.33	1.20
1986	48,952	174,309,078	82,680,545	29,161	119,054,329	0.68	1.13
1987	46,492	130,869,228	64,143,405	25,547	87,240,750	0.67	1.09

Source: Annual Crop Insurance Report (1987-88) page 31.

Table 1.3: Acreage Insured by Crop in the Saskatchewan Crop Insurance Program.

(1000's of acres)

WHITE								FALL	SUN-	UTILITY		FIELD			CANARY	SPRING	FABA-	WINTER	SWEET	TRITI-		
YEAR	DURUM	WHEAT	SPRING	BARLEY	OATS	FLAX	CANOLA	RYE	FLOWERS	WHEAT	MUSTARD	PEAS	FORAGE	LENTILS	SEED	RYE	BEANS	WHEAT	CLOVER	CALE	TOTAL	AVERAGE
1961		29		2	3																34	160
1962		180		18	28																226	169
1963		305		29	38																372	166
1964		415		26	23																464	197
1965		512		37	21																571	80
1966		1,183		143	21																1,346	193
1967		1,593		190	23																1,806	220
1968		2,742		214	35																2,991	242
1969		2,145		216	37																2,398	206
1970	137		50	263	24																1,004	111
1971	149		1,00	251	25																1,465	186
1972	385		1,64	362	41	41	146														2,589	218
1973	716		4,72	1,009	235	153	388		2	1											7,236	303
1974	360		5,65	1,508	431	219	546		14	0	42	69									9,804	312
1975	2,073		6,63	1,519	560	228	882		30	1	67	34									12,066	316
1976	1,870		8,453	1,389	549	90	329		49	1	60	18	3								12,812	327
1977	1,217		10,368	2,247	747	366	775		48	2	265	73	10								16,117	342
1978	2,266		8,693	1,631	476	222	1,416		83	2	227	73	10	9							15,108	351
1979	1,713		8,706	1,270	361	387	1,616		79	4	58	44	13	8	14	24	5				14,312	356
1980	2,148		9,783	1,796	481	247	1,085		89	11	44	111	18	11	43	51	13				15,931	371
1981	2,749		11,097	2,181	546	211	686		138	5	38	75	16	14	45	40	18	0			17,859	386
1982	2,238		11,251	2,050	461	275	757		147	4	35	50	27	39	64	90	25	0			17,511	390
1983	2,087		11,855	1,614	326	124	1,113		135	1	26	94	22	15	56	48	8	1			17,525	408
1984	2,561		10,932	1,823	376	372	1,770		106	6	59	165	29	24	76	68	9	2			18,377	423
1985	2,900		11,853	2,219	469	430	1,803		119	6	168	222	44	100	110	85	23	1	416	9	20,978	450
1986	3,173		13,298	2,395	468	502	1,666		188	6	156	271	103	202	219	131	29	3	602	3	23,455	479
1987	3,711		11,675	2,497	457	352	1,628		165	11	60	117	207	99	333	159	15	4	264	2	21,807	469

Source: Saskatchewan Crop Insurance Annual Report (1987-88):32.

In 1966, the province was divided up into crop risk areas as determined by general soil classification, climate and historical production differences. In addition, each quarter section within each risk area was given an additional rating known as a soil productivity index. This index was used for more detailed coverage purposes and was based on interpretations of land inventory maps by University of Saskatchewan personnel. This classification system became the blueprint of the crop insurance system in use today. Prior to the implementation of this system, risk areas were grouped on a township basis.

In 1967, the federal government increased its premium contribution for a second time. Based on the new changes they paid 25 percent of the premium with the farmer picking up the remaining 75 percent.

In 1972, the crop insurance program was expanded to all areas of the province. With this expansion, south and north western regions of the province became eligible for coverage. This lead to a substantial increase in farm numbers insured as illustrated in Table 1.2. In addition, rapeseed and flax were added as insurable crops. This followed the separation of wheat into the two categories of spring wheat and durum wheat in the previous year. Finally, interested producers were given the additional option of insuring up to 70 percent of their area average yield.

In 1973, the provincial governments accepted the responsibility of paying the total cost of administrating the program. The federal government increased their premium contribution to 50 percent of the actuarial sound premium. Participating producers paid the other 50 percent. Coverage was expanded to include spot loss hail. Fall rye and sunflowers were added as additional crops.

In 1974, unseeded acreage insurance was made available. From 1974 to 1984 this acreage insurance provided a minimum level of return for summerfallow acreage which could not be seeded on or before June 25. In 1985, the program was expanded to include unseeded stubble land as well. In 1986, a $15 per acre establishment benefit was introduced which was similar to the unseeded acreage insurance, except that it pertained to fall-seeded crops which did not emerge in the spring.

In 1985, an individual coverage option was made available. This third insurance option allowed for 80 percent coverage based on the 10 year average of the individual farmer's yield (as opposed to the 60 and 70 percent options that were calculated for the average area yield).

In 1986, a multi-year disaster benefit was added. Insured producers who used the 60 or 70 percent area-based coverage scheme, and who lived in areas that had suffered major losses in each of the two preceding crop years, were given an additional coverage of 10 percent. This program was the first step in a series of ongoing changes that are being made to the crop insurance program to deal with multi-year crop disasters (i.e., drought). It was hoped that these additional measures would preclude the need of future ad hoc programs.

Overall, the Saskatchewan crop insurance program has been reasonably successful in attracting farm clientele. This is best exemplified by Table 1.2, which illustrates the number of farms participating in the program since its inception in 1961. In fact, since 1972 when crop insurance expanded coverage to all areas of the province, there has been a steady upward trend in farmer participation so that by 1987, the participation rate was over 75%. However not all farmers in the program insure all crops.

In addition, the program appeared to be actuarial sound based on the accumulated loss to revenue figures presented in Table 1.2. However, recently the program has fallen into a slight deficit with large payouts in the two consecutive years of 1984 and 1985. This deficit is much greater today after the record payouts attributed to the drought of 1988.

Currently, the entire crop insurance program is under extensive review. Recent ad hoc assistance payments (i.e., 1988 drought assistance program), subsidy negotiations at the General Agreement on Trade and Tariffs (GATT), and proposed changes in federal funding of the program have all contributed to this review process. It is hoped that this study will aid policy makers in the redesign of the current program so that the above problems can be alleviated, and at the same time maintain all risk crop insurance as a useful, beneficial and equitable program for prairie farmers.

CHAPTER II

FARM MANAGEMENT DECISIONS WITH CROP INSURANCE

2.1 Introduction

Little is known about how agricultural practices on the prairies have been affected by the Saskatchewan All Risk Crop Insurance program. Recent literature in the area of agricultural insurance has been more concerned with whether a private market for crop insurance can exist (Nelson and Loehman, 1987; Chambers, 1989; Ashan, Ali and Kurian, 1982). This report focuses more heavily on the farm management implications of crop insurance. The existence of a private insurance market for crop insurance is not an immediate concern for Saskatchewan agriculture since the federal and provincial governments maintain they are firmly behind subsidizing crop insurance as they have in the past (Agriculture Canada, 1989).

The purpose of this chapter is to examine at a theoretical level how crop insurance affects farm management decisions. This analysis will provide many useful and testable hypotheses in the empirical sections to follow.

Section two of this chapter develops a theoretical model of crop insurance which incorporates production risk as well as the risk attitudes of farmers. Particular attention is paid to explaining how crop insurance affects crop selection, land use and input use. In addition, some time is spent explaining the incentives created for moral hazard and adverse selection by Saskatchewan All Risk Crop Insurance.

2.2 Conceptual Model

In this section, a theoretical model is developed to examine the influence that all risk crop insurance has on farm management decisions. Specifically, the model describes how risk attitudes affect optimal expenditure on crop insurance. In addition, it indicates how crop insurance affects optimal input use and agricultural production by examining the simple one-factor one-product case.[9]

In this model we assume that all producers maximize utility for a single year and all producers have quasi-concave von Neumann-Morgenstern utility functions (i.e. they are either risk neutral or risk averse over all levels of uncertain income).[10] In addition, we assume that all farmers produce a single crop (Y) and apply one input (X)[11]. Furthermore, the production function has the usual properties; $dY/dX \geq 0$ and $d^2Y/dX^2 \leq 0$. To incorporate the variance of production, we employ a method analogous to Ashen et al (1982) who examined the conditions necessary for a private all risk crop insurance market. Therefore, we assume two states of the world can occur, each with a specified probability. We assume that in state 1 a normal yield occurs with a probability $\theta(M)$ where $0 \leq \theta(M) \leq 1$. In contrast, total crop failure occurs in state 2 so that the only return is the guaranteed yield paid by a crop insurance program. This occurs with a probability of $[1 - \theta(M)]$. Note that the probability of state occurrences depends upon a variable M which we denote as the quality or level of some arbitrary fixed resource. In more practical terms this variable could represent the level of available soil moisture at seeding time, land quality, or management ability.[12] We assume that $\theta(M)$ has the following properties; $\theta'(M) \geq 0$ and $\theta''(M) \leq 0$. Equations (2.1) and (2.2) below illustrate the two possible levels of profit (π_1 and π_2) which may accrue to the producer prior to his decision to seed.

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[9] Anderson, Dillon and Hardaker (1977) give an excellent overview of production under risk for the one-factor one-product case. This section of the study adds crop insurance as a second input to this simple case. More recently, Newberry and Stiglitz (1981) have added to this discussion, but in the perspective of price stabilization rather than crop insurance.

[10] Obviously, one limitation of the above model is that producers make decisions in a dynamic environment. However, we keep the model simple since it indicates many important relationships that apply in a dynamic situation.

[11] We abstract away from the debate of whether an input is risk reducing or risk increasing (Nelson and Loehman, 1987; Just and Pope, 1987). Rather we assume X is risk increasing since it is difficult to perceive an input in prairie agriculture that is risk reducing.

$$\pi_1 = pY(X) - cX - q(I), \text{ with } \theta(M) \text{ probability.} \tag{2.1}$$

$$\pi_2 = pY^c(I) - cX - q(I), \text{ with } [1 - \theta(M)] \text{ probability.} \tag{2.2}$$

where p is the price of output, Y is yield, X is the level of variable input use, q(I) is the insurance premium, I is the amount of insurance purchased and $Y^c(I)$ is guaranteed crop insurance yield as a function of the level of coverage purchased.

Therefore, we assume that the individual producer maximizes expected utility as illustrated in equation (2.3) below:

$$\max_{X,I} V = \theta(M)\ U(\pi_1) + [1 - \theta(M)]U(\pi_2) \tag{2.3}$$

where V is total expected utility, and $U(\pi_1)$ and $U(\pi_2)$ are the expected utility associated with the two different states of the world. The first order conditions of equations (2.4) and (2.5) illustrate the marginal conditions of utility maximization faced by the individual producer.

$$\partial V/\partial X = \theta(M)\ U'(\pi_1)[(p)(\partial Y/\partial X) - c\ ] + [1 - \theta(M)]\ U'(\pi_2)(-c) = 0$$

$$\theta(M)\ U'(\pi_1)(p)(dY/dX) = [1 - \theta(M)]\ U'(\pi_2)c + \theta(M)\ U'(\pi_1)c \tag{2.4}$$

$$\partial V/\partial I = \theta(M)\ U'(\pi_1)(-\partial q/\partial I) + [1 - \theta(M)]\ U'(\pi_2)\ [(p)\partial Y^c/\partial I - \partial q/\partial I] = 0$$

$$[1 - \theta(M)]\ U'(\pi_2)(p)(\partial Y^c/\partial I) = \theta(M)\ U'(\pi_1)\partial q/\partial I + [1 - \theta(M)]\ U'(\pi_2)\partial q/\partial I \tag{2.5}$$

---

[12] It could also be a combination of all three factors since it is likely that all three have an impact on the probability distribution of yield.

Equation (2.4) illustrates the marginal conditions of input use. The left-hand side (LHS) of equation (2.4) is the addition to total utility of an increase in the use of X. In contrast, the right-hand side (RHS) shows the expected marginal factor cost of input use. Solution of the equation yields the optimal level of X to apply.

The LHS of equation (2.5) gives the addition to total utility of an increase in the guaranteed yield (i.e. the expected value of indemnity) of crop insurance. The RHS is the marginal factor cost (premium) of the increase in terms of utility. Therefore, equating the LHS and RHS of equation (2.5) gives the optimal level of crop insurance to purchase.

Note that equations (2.4) and (2.5) are slightly different than the case of production under certainty. Under certainty, the typical conditions for profit maximization and utility maximization is where the value marginal product for input i equals its marginal factor cost. However, if we assume that the producer is risk neutral (i.e. $U'(\pi_1) = U'(\pi_2)$) then we get the traditional result that the expected value of the marginal product of input i equals its expected marginal cost. This is easily shown if the condition of risk neutrality is applied to equations (2.4) and (2.5) since all terms representing the marginal utility of profit cancel out. Equation (2.4) and (2.5) simplify to;

$$\theta(M)(p)[\partial Y/\partial X] = c, \text{ and} \qquad (2.6)$$

$$(1-\theta(M))(p)[\partial Y^c/\partial I] = \partial q/\partial I \qquad (2.7)$$

Therefore, the risk neutral producer will equate expected value marginal product to expected marginal factor cost. It is from this bench mark that we will examine the decision behaviour of the risk averse producer.

Risk averse individuals are characterized by von Neumann-Morgenstern utility functions which are strictly concave. Consequently, if π_1 in equation (2.1) is greater than π_2 in equation (2.2), we know that $U'(\pi_2) > U'(\pi_1)$. To show how this result affects input use divide equation (2.4) by $U'(\pi_1)$ and equation (2.5) by $U'(\pi_2)$ to get the following:

$$\theta(M)(p)[\partial Y/\partial X] = [1 - \theta(M)]\,[U'(\pi_2)/U'(\pi_1)](c) + \theta(M)c \qquad (2.8)$$

$$[1 - \theta(M)](p)[\partial Y^c/\partial I] = \theta(M)\,[U'(\pi_1)/U'(\pi_2)](\partial q/\partial I) + [1 - \theta(M)](\partial q/\partial I) \qquad (2.9)$$

In the case of equation (2.8), since $[U'(\pi_2)]/[U'(\pi_1)] > 1$, the risk averse producer perceives a higher marginal factor cost than the risk neutral producer and uses less of the variable input. It is also interesting to note that π_2 depends crucially on the level of the guaranteed yield Y^c. Therefore, without crop insurance, the ratio of $[U'(\pi_2)]/[U'(\pi_1)]$ would be much larger than with crop insurance, since $d[(U')(\pi_2)/(U')(\pi_1)]/dY^c < 0$. With complete insurance coverage (i.e. $Y^c(I) = Y(X)$), $U'(\pi_2)/U'(\pi_1) = 1$ and the risk averse individual acts exactly like the risk neutral producer (i.e. he uses the same amount of X).

Equation (2.9) shows that the risk averse individual is willing to pay a higher insurance premium than the risk neutral individual since $U'(\pi_1)/U'(\pi_2) < 1$. In essence, to avoid unwanted risk, the risk averse individual discounts the cost of the insurance and buys more coverage.[13] Intuitively, the economics of the decision to purchase insurance can be illustrated graphically as shown in Figure 2.1. This figure shows a simple production function relating expected ex-ante yield (Y) to levels of a single variable input (X). It is assumed that the farmer has already decided to seed wheat and that the optimal amount of the variable input

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[13] Furthermore, the greater the individual's level of risk aversion, the more he will discount the cost of insurance relative to the benefits.

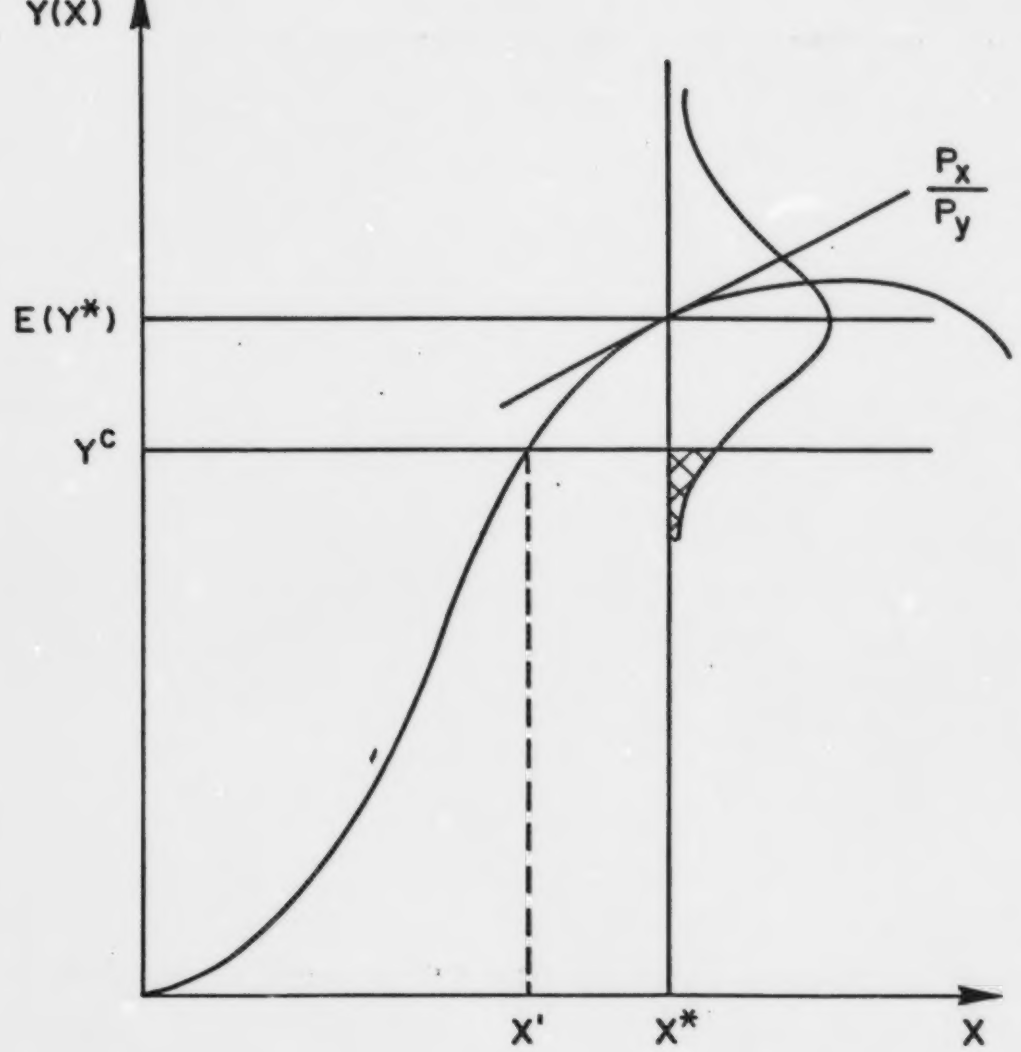
Y(X)
$\frac{P_x}{P_y}$
E(Y*)
Y^c
X'
X*
X

FIGURE 2.1 WILLINGNESS TO PAY FOR CROP INSURANCE

apply is X^*. As a result, the expected yield is Y*. However, producers realize at seeding time that they are unlikely to achieve their expected yield. They realize the expected yield is based on a yield distribution represented by the bell shaped curve centered about Y^*. Given the distribution of yield, we assume that the producer has the opportunity to purchase crop insurance with a guaranteed yield indicated by Y^c in Figure 2.1.[14] The question then is; what is a producer willing to pay to have the level of coverage denoted by Y^c. If the producer is risk neutral, he equates expected marginal cost to expected marginal revenue. In other words, he is willing to pay a price for the insurance up to the point where he breaks even on the possibility that he will collect. Therefore, the value of the insurance to him is:

$$\text{Expected Value of Insurance} = p*\int_0^{y^c}(y^c - y)\, f(y/x) * dy \qquad (2.10)$$

where p is the price of the commodity he produces (wheat), f(y/x) is the probability density function of yield given a particular level of input use, and y^c is the guaranteed yield provided by crop insurance. As expected, the risk neutral individual will buy insurance up to the point where its marginal cost equals its expected marginal benefit. In contrast, the risk averse individual will discount the marginal cost of insurance, and as a result is willing to pay more than the risk neutral individual for the same level of coverage. Consequently, both the mathematical model illustrated in equations (2.1) through (2.9) and graphical model yield the same conclusions regarding the decision to purchase crop insurance.

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[14] The probability associated with falling below the guaranteed yield associated with Y^c is the cross-hatched area in Figure 2.1.

Therefore, if we assume that all farmers in the province of Saskatchewan are homogeneous with respect to management ability and farm practices, the model of crop insurance illustrated above yields the following points. First, all rational utility maximizing producers, regardless of their level of risk aversion should participate in crop insurance. This conclusion is based on the fact that farmer's premiums for crop insurance represent 50% of the actuarial sound premium rate.[15] Therefore, expected indemnities should be double the premium cost (see equation (2.7)). Second, with insurance risk averse producers will tend to use a greater level of inputs than without insurance (see equation 2.8). Intuitively, they increase their input use because the risk of crop production has been reduced. Third, with full insurance (i.e. producers are insured for yields equal to their expected yield in the "good" state) all producers will use the same level of inputs regardless of their level of risk aversion (compare equations (2.6) and (2.8) for $\pi_1 = \pi_2$).

Obviously, the above assumption regarding the homogeneity of management ability and farm practises is unrealistic. Empirical evidence refuting the assumption is best exemplified by the fact that not all farmers participate in crop insurance (see Table 1.1). However, even the heterogeneity of farm management ability and practises would not be a serious problem to a crop insurance program if the insurer could offer individually tailored contracts to each and every farmer based on his management ability, land quality as well as any other characteristics which determines the productivity of the farm. Unfortunately though, even if this was administratively feasible, it is virtually impossible for the insurer to distinguish a farmer's management ability based on a single meeting to sign an insurance contract. This lack of information

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[15] The federal and provincial governments together pay the remaining 50%.

(asymmetry) on the part of the insurer is the single factor which causes two major problems associated with crop insurance. The literature denotes these as adverse selection and moral hazard. (Pauly, 1974; Nelson & Loehman, 1987).

Recent research addressing the implications of crop insurance on agriculture have dealt with the problems of moral hazard and adverse selection (Nelson and Loehman, 1987; Skees and Reed, 1986). In fact, the conceptual model illustrated in equations (2.1) through (2.9) is a simplified exposition of the most recent research in the area. We maintain that this literature has made a significant contribution, but that they do not adequately deal with the issues of selective participation and moral hazard. The next two sections of this chapter provide a more rigorous theoretical explanation of these two problems, as they apply to a general crop insurance program in a dryland agricultural region.

2.3 Adverse Selection

Since the insurer cannot distinguish between the management ability of various farmers, they are forced to offer all farmers an identical insurance contract.[16] Therefore, if the insured yield is calculated as the average for a given area, higher yielding producers may find the program less attractive than lower yielding producers. In the simple economic model of equations (2.1) through (2.9) we made the argument that the probability of a "bad" year ($1-\theta(M)$) was a function of management ability (M). Therefore, the better the manager, the lower is the probability of a poor year, and consequently the less valuable is a fixed contract based on average management ability.[17] Based on equation (2.7), good managers with a low probability of poor yields may not find the fixed contract insurance program economical. This creates two problems for the insurer. First, only the lower level management producers participate in the program. Therefore, a program based on average yields of all producers in a given area will not be actuarial sound since farmers from the upper end of the yield distribution will not participate. Second, if the yield coverage offered by the insurer is based on those farmers who do participate, it will result in even greater adverse selection since the higher yielding producers who do not participate are not calculated in the area average. This may be a significant problem for the Saskatchewan program, since for many crops, record of production yields collected from participating farmers are used to calculate area average and guaranteed yields. Given the fact that many producers do not purchase crop insurance, even with the matching government contribution, suggests that adverse selection may be a serious problem in the Saskatchewan All Risk crop insurance program.

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[16] In Saskatchewan, these contracts are tailored to the productivity of different land quality and climatic regions using what is known as risk areas (climate) and soil productivity indexes (land quality). However, on a particular land type and climate, the insurance contract offered is the same for all.

Since the decision to participate in crop insurance can be made on an annual basis, it is possible that another situation of adverse selection may occur. Once again, we will use the model described in equations (2.1) through (2.9) to explain how this may occur.[18] As before $\theta(M)$ represents the probability of a "good" year, but now M represents soil moisture available at seeding time. Available soil moisture at seeding time has been shown to be an important variable in determining expected crop yield (Weisensel, 1988). Therefore, it seems reasonable that it may be an important variable in the decision of whether or not to participate in crop insurance (see equation (2.7)).[19] Since the guaranteed yield offered by crop insurance does not respond to changes in soil moisture in a given spring, the expected value of crop insurance is much greater in years when available soil moisture at seeding time is low (i.e. in equation (2.7), $[1-\theta(M)]$ is large). Consequently, it is possible that a producer may find it profitable to participate in crop insurance one year and not another. Therefore, he will selectively participate for the years he expects to be paid an indemnity. Obviously, to the extent that this occurs, the program cannot be actuarial sound unless those farmers who always participate are paying for those who selectively use the program.[20]

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[17] In contrast, lower level managers are much more likely to participate since their expected value of indemnities is high.

[18] We assume risk neutrality since the case of risk averse producers is a simple extension of the risk neutral case (see equation (2.9)).

The implications of adverse selection become obvious when one compares the outcome of the "homogeneous" farmer model to the two situations outlined above. In either case, average and above average producers are paying for below average producers and those who selectively participate. At the extreme, you can get the situation where some producers do not find it worthwhile to participate because other producers are being paid a disproportionately high level of indemnities. Unfortunately though, the problem of adverse selection may not be the only reason why the distribution of indemnities may be inequitable. A second reason may be moral hazard.

2.4 Moral Hazard

The conceptual model illustrated earlier indicates that a risk averse farmer with crop insurance will tend to use more inputs than the same farmer without crop insurance. However, this result is based on the assumption that the incentives created by participation in the insurance program do not conflict with farm decisions in the absence of insurance. Holmstrum (1979) defines moral hazard as an alteration in input use which deviates from social optimality due to conflicting incentives and asymmetric information. Consequently, moral hazard occurs when a producer takes some action with respect to input use, which makes him more likely to collect an indemnity, than the socially optimal input use without crop insurance would suggest (see equation 2.8).

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[19] A farmer wishing to participate in crop insurance has to make his decision by April 30. On April 30, he must decide which crops he is insuring.

[20] Since the Saskatchewan program is government subsidized, both the government and continuous participators pay.

Recent literature in the area of agricultural insurance attempts to model moral hazard in the factor market by examining the traditional profit maximizing condition that expected value marginal product of input i is equal to the marginal factor cost of input i (Nelson and Loehman, 1987; Loehman and Vandeveer, 1989). Basically, they assume that incentives created by the insurance program drive a wedge between the relationship illustrated in equation (2.8) (see Nelson and Loehman 1987 (equation 15)). Consequently, input use may be less or greater than the social optimum. In what follows, we examine the moral hazard problem more rigorously then it has been examined in the most recent literature. We point out that moral hazard is a binary problem which yields two possible outcomes. The first outcome is the case where moral hazard occurs and results in the producer using no inputs.[21] The second outcome is where moral hazard is not a problem and then input use is at the social optimum as illustrated in equation (2.8). Below we describe how and why moral hazard occurs in the risk neutral case.[22]

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[21] Note that this is a corner solution with respect to input use which needs only one qualification. The producer must apply some minimum level of inputs for him to be eligible for insurance (i.e. he must seed the crop).

[22] Later we will expand this assumption to determine the implications for a producer displaying risk averse behaviour.

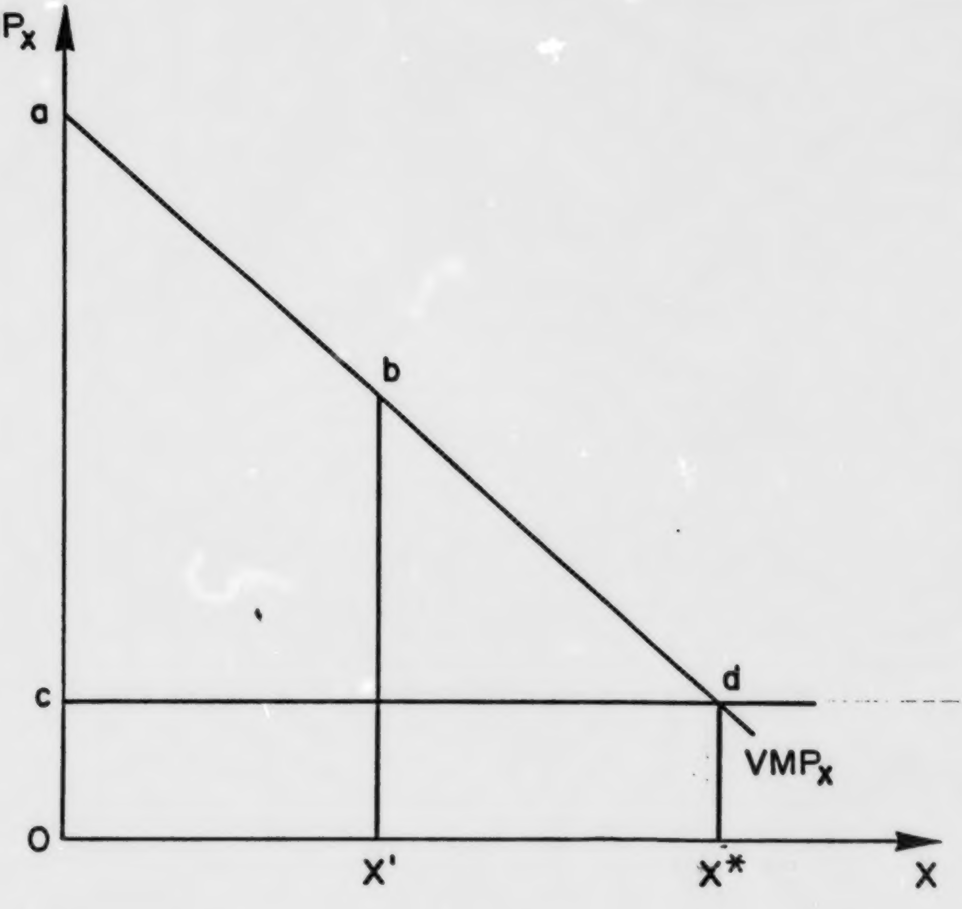
VMP$_x$
a
b
c
d
VMP$_x$
O
X'
X*
X

FIGURE 2.2 AN EXAMPLE OF MORAL HAZARD IN THE FACTOR MARKET WITH RISK NEUTRALITY

The expected profit maximizing farmer who purchases a crop insurance contract realizes that his gross income is constant for all yields less than the guaranteed yield offered by crop insurance, regardless of his decision about the level of input use. Figure 2.1 illustrates this point clearly showing that the producers "effective" expected yield does not decrease with input use less than X'.[23] Figure 2.2 illustrates the factor use decision for stage II of the yield function illustrated in Figure 2.1. In Figure 2.2, optimal input use is determined by the intersection of expected value marginal product (ad) and marginal factor cost (0c) at use level X*. The consumer surplus associated with the optimal input use is the area acd. This represents the maximum return over variable cost of production in the single factor case. Alternatively, the producer realizes he can receive an "effective" yield of Y^c (Figure 2.1) even if he applies no X. The minimum amount of X necessary to achieve Y^c in Figure 2.2 is X'. Therefore, as an alternative to applying X*, the farmer can apply no inputs and receive the surplus associated with the input use X' at no cost. The total welfare associated with this decision is the area abX'0. Therefore, the rational profit maximizing producer will apply no inputs if the area acd $\le$ abX'0 and X* level of inputs if acd > abX'0.[24]

Alternatively, the same result can be shown, perhaps more intuitively, in the output market with producer surplus.[25] In Figure 2.3, we illustrate the planning supply function (S) for the farm firm with an expected price equal to P. The producer surplus associated with the profit maximizing level of output Y* is the area Pa0. In comparison, the producer can make the decision to use no inputs and still receive the insurance indemnity equal to the area PbY^c0. In both cases, we are assuming that the producer has already made the decision to participate in crop insurance.[26] Thus, since the costs associated with seeding and insurance are already fixed they are not incorporated in the marginal analysis of Figure 2.3. Consequently, the expected profit maximizing producer will use no inputs if area $PbY^c0 > Pa0$ and the optimal level of inputs associated with output level Y* if area $Pa0 > PbY^c0$. This raises the question of how risk averse producers approach the moral hazard problem.

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[23] Effective yield is the yield figure which the farmer uses to calculate gross income/acre. Actual physical expected yield may be less than the effective yield.

[24] This result can be generalized to the case of many factors provided that you measure the consumer surplus as the area under the derived demand curve and above the price line for a market where positive input use is required for positive output (Just, Hueth and Schmitz, 1982).

[25] From an empirical perspective, it may be easier to demonstrate moral hazard in the input market, since one is more likely to have an estimate of the derived demand curve as opposed to the marginal cost curve. However we show moral hazard in the output market for ease of explanation.

Suppose the representative producer illustrated in Figure 2.3 is risk averse. Theory suggests that his planning supply curve must shift to the left (S to S') to account for his risk premium.[27] Therefore, a producer displaying risk averse behaviour is more likely to be a case of moral hazard since his producer surplus (area Pc0) is less than a risk neutral producer with similar cost structure (area Pa0). Consequently, risk averse producers are more likely to prefer the use of no inputs and collect the insurance indemnity because it has the least risk associated with it.

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[26] The producer must seed to be eligible for crop insurance.

[27] The vertical difference between S and S' represents the size of the risk premium. The more risk averse the producer the larger the premium and the greater the shift in the planning supply curve (MC function).

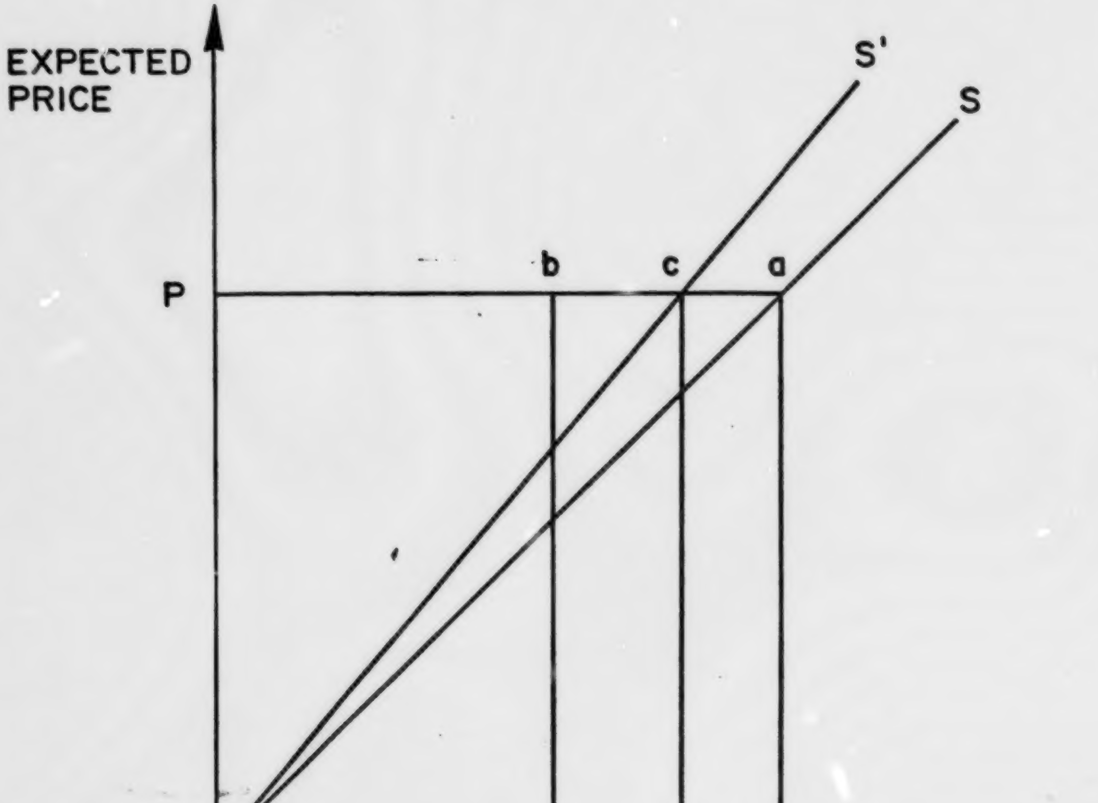
EXPECTED PRICE
S'
S
b
c
a
P
O
Y^C
Y^R
Y*
EXPECTED YIELD

FIGURE 2.3 MORAL HAZARD IN OUTPUT MARKET AND THE CASE OF RISK AVERSION

Generally, it would appear that moral hazard is a greater problem with those producers who exhibit lower than average management, since their planning supply curves are to the left of higher level managers (i.e., they are less efficient). However, it is important to note that the moral hazard problem may effect both poor and good producers alike.[28] In years when available soil moisture at seeding time is critically low, the planning supply curve shifts to the left for all producers. Therefore, since the yield guarantee offered by crop insurance does not respond to this change in yield expectations, more producers are likely to see moral hazard as the optimal strategy on their farm. For example, consider the extreme case of a producer (high or low level management) whose expected yield is less than the guaranteed yield offered by crop insurance due to poor moisture conditions. Consequently, in prairie agriculture, where soil moisture is often limiting, moral hazard may not be limited to "poor producers" or "insurance abusers".

In Figure 2.4, we illustrate how changes in market prices for crops insured by a crop insurance agency may affect the incidence of moral hazard. When market prices fall, the level of coverage offered by crop insurance falls by the price change multiplied by the guaranteed yield coverage (see Figure 2.4). Initially, we assume the risk neutral producer is expecting price P_0, and plans to produce Y^*_0. Thus, the producer is indifferent between using the optimal level of inputs to produce Y^*_0 and using no inputs and collecting the indemnity (area P_0bY^c0).[29] With a price reduction from P_0 to P_1, the producer surplus associated with the socially

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[28] However, by definition a lower level manager is more likely to prefer the moral hazard solution in every case we examine since his producer surplus is less.

[29] With an elasticity of supply of 1.0 and a guaranteed crop insurance yield (Y^c) equal to one half of the expected yield Y^*_0, the risk neutral producer will be indifferent between using no inputs and the optimal level of inputs.

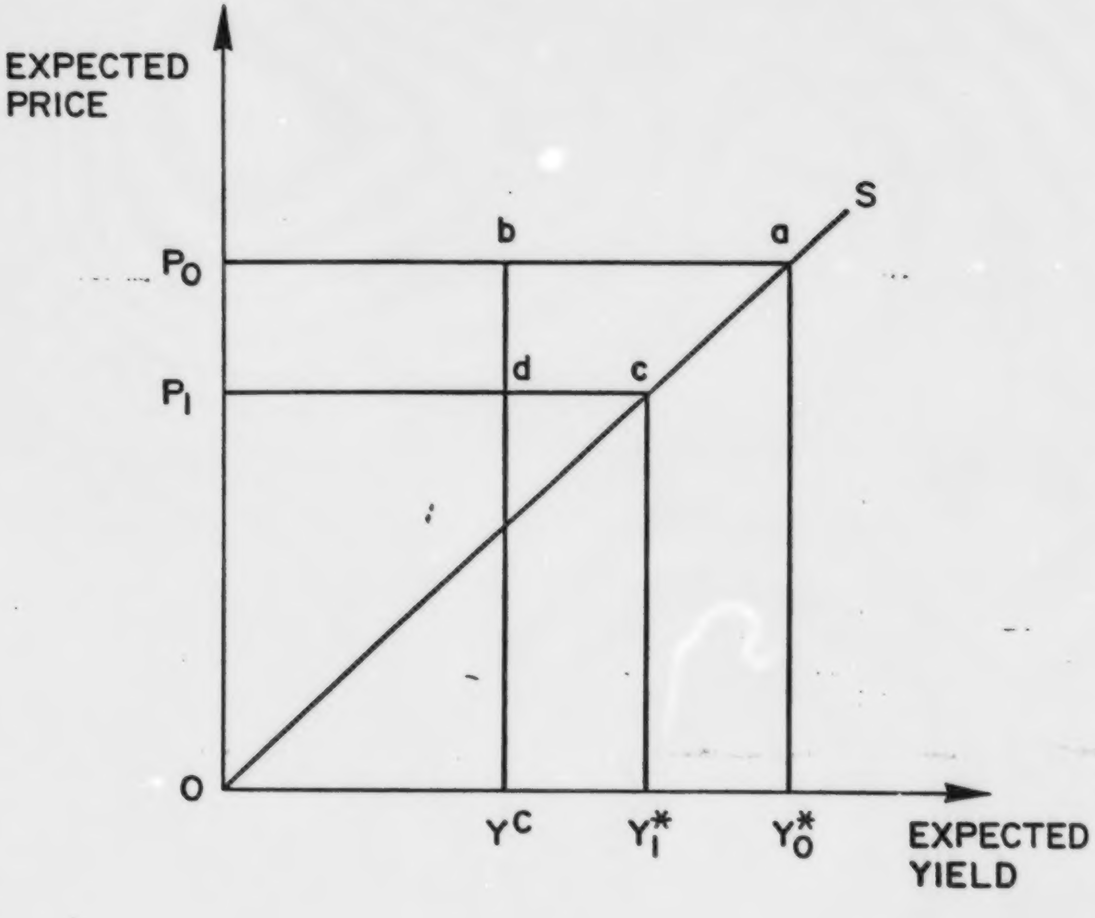
EXPECTED PRICE
S
b
a
P_0
d
c
P_1
O
Y^C
Y_1^*
Y_0^*
EXPECTED YIELD

FIGURE 2.4 IMPLICATIONS OF AN OUTPUT PRICE DECREASE AND MORAL HAZARD

optimal level of input use falls by the area P_0acP_1. Since $P_0bdP_1 < P_0acP_1$, it appears that a reduction in output price with a given guaranteed yield increases the likelihood that moral hazard will occur.[30] This result may have important implications since most crop insurance programs are based on guaranteed yields which are invariant to changes in market price.

2.4.1 Repeated Insurance and Moral Hazard

One major limitation of the above analysis of moral hazard is that it fails to recognize the dynamics of an insurance contract. In other words, that the insurer may revise its insurance contract after it has observed the actions of the insured.[31] Some research in the general area of insurance has dealt with this issue (Lambert, 1983; Rubenstein and Yaari, 1983; Rogerson, 1985). Basically, this research has examined how premium incentives for clients with good records and premium penalties for clients with poorer claim records could curtail the incidence of moral hazard in an insurance contract.

The Saskatchewan All Risk Crop Insurance program uses both premium discounts and yield coverage adjustments to discourage moral hazard and to adjust the contract for cases of adverse selection. One could examine the effectiveness of the current coverage adjustment system by expanding the analysis illustrated in Figures 2.2 through 2.4 to a multiple period planning horizon. However, an exercise of this nature would require substantially more research into yield response to input use and the dynamics of available soil moisture. This is beyond the scope of the current study, but it would be an interesting and useful area for future research.

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[30] If one compares the producer welfare associated with moral hazard at P_1 (area P_1dY^c0), it is quite obvious that it is greater than the producer surplus (area P_1c0). Therefore, the optimal strategy is to apply no inputs.

[31] By actions, we mean that the insurer observes the outcome of the farmer's actions but not the farm practices which led to the outcome. Therefore, he has less information than the producer.

2.5 Enterprise Selection and Land Use

A second limitation of the theoretical model discussed in this chapter is the assumption that a single output is produced. However, it is not difficult to expand the model to incorporate more crops. The implications of an expansion to more crops are as follows. First, risk neutral producers will choose those crops which yield them the highest expected return regardless of the risk associated with them. Therefore, crop insurance will not influence upon the crop choice for risk neutral producers providing that the insurance coverage offered on each of the crops does not change the ranking of relative crop profitability from how it would be without crop insurance. If some crops are covered by crop insurance and others are not, crop selection may be affected if the crop insurance coverage causes a change in the ranking of relative profitability of crops.[32] Whether this case actually exists for any crops is an empirical question.

In contrast, risk averse producers will trade off higher expected profits to reduce their risk. Consequently, their crop selections are more likely to be affected by a crop insurance program. Particularly, if some of the crop choices available to the producer are not covered by crop insurance. However, this again is an empirical question which depends on the expected profitability and risk of the crops in question, as well as the level of risk aversion of the producer (Weisensel and Schoney, 1989). Therefore, if crop insurance does affect crop selection, this should show up in the empirical work to follow.[33]

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[32] Only insurance coverage on crops with a net benefit (expected indemnities > premium cost) will change the expected profitability of a crop. However, by definition a risk neutral producer will only insure crops where insurance has a positive net benefit. If all crops are insured by the producer (i.e., all have positive net benefits) then relative crop profitability can only change if the net insurance benefits of one is substantially greater than the net insurance benefits of another.

Finally, one of the major objectives of the current study is to investigate the impacts of crop insurance on land use. Traditionally, economists have examined land use questions using the concept of economic rent, which maintains that land will be put to use in the activity which yields it the highest possible return. Therefore, since crop insurance is subsidized and tied to a particular agricultural enterprise (i.e., grain), economic analysis suggests that crop insurance has to affect land use, and consequently, livestock numbers, at least for land which is at the margin of production. Therefore, from a theoretical perspective one would suspect that crop insurance does have some impact on marginal land use, but the extent to which this is a problem is an empirical question which we will attempt to address in later chapters.[34]

2.6 Crop Insurance and Extended Cropping

A final limitation of the conceptual model illustrated earlier in the chapter is its inability to deal with the dynamics of the crop/fallow decision. Therefore, we provide no theoretical evidence regarding the implications of crop insurance in this decision. This is not an oversight, but rather an attempt to avoid the conceptual difficulties associated with incorporating risk behaviour within a dynamic model.[35] Intuitively, in the risk neutral case, one would expect that the extent to which crop insurance affects the decision to stubble crop depends upon two factors. First, it depends upon the expected net benefit associated with insuring a stubble crop as opposed to a summerfallow crop.[36] Second, it depends upon the relative profitability of the stubble cropping decision. For instance, if a more intensive crop rotation has the same level of profitability as a 50/50 wheat-fallow rotation, a risk neutral producer without insurance will be indifferent between the two. However, if crop insurance provides a greater expected net benefit to stubble cropping, the same producer will prefer the more intensive rotation. Therefore, in regions where stubble cropping is a marginal decision, the net benefit of crop insurance for stubble crops as compared to summerfallow crops may affect the decision to crop or fallow. We provide theoretical and empirical results regarding the value of crop insurance on stubble and summerfallow in chapter V. In addition, we test whether there are differences in level of stubble cropping between participators and non-participators in Chapter IV.

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[33] The above theoretical discussion contends that crop insurance will tend to reduce the number of crops grown. Offsetting this, is the fact that seeding more crops allows the farm operator to split the risks of growing crops on his farm. Since crop insurance treats different crops separately, seeding more crops means the farmer can insure different parcels of land separately.

[34] From an empirical perspective, it may be difficult to separate out the effects that crop insurance has had on marginal land use relative to the myriad of other government programs which probably have had more significant impacts on land use (i.e., the Crow Benefit, Special Canadian Grains program and WGSA). Therefore, we will test the influences that crop insurance has on land use in an indirect manner by examining differences in livestock income between participators and non-participators.

2.7 Conclusions

The purpose of this chapter was to develop a theoretical model to explain the individual decision to participate in crop insurance and the influences that participation in crop insurance may have on farm management decisions. The theoretical model yields the following conclusions.

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[35] Recent literature suggests that the Von Neuman-Morgenstern utility function approach to modelling individual behaviour cannot be consistently applied in a dynamic environment, because it fails to incorporate the impacts that wealth has on risk behaviour (Newberry and Stiglitz, 1981).

[36] The expected net benefit of insurance is equal to the value of equation (2.10) less the premium cost.

Producers participate in crop insurance if participation results in an increase in total utility. Therefore, risk neutral (profit maximizers) producers participate if the expected indemnities from participation are at least as great as the premium cost. Since producers are heterogeneous with respect to management ability and the crop insurance program is based on an area average approach, one would expect that participators have lower yields (or more variable yields) than non-participators. Furthermore, producers with higher expected yields still may find it rational to participate in crop insurance on a selective basis. The conceptual model suggests that these producers will participate in years when soil moisture levels and thus expected yields are lower than their long-term average.

Risk averse producers are more likely to participate than risk neutral producers with the same distribution of yields since they tend to discount the cost of insurance. Furthermore, the conceptual model suggests that participation in crop insurance will tend to increase the risk averse individuals level of input use and level of output.[37] Therefore, the risk diversifying impacts of crop insurance may result in an increase in aggregate production for the province as a whole.

In contrast to an increase in input use, participation in crop insurance may result in conflicting incentives (moral hazard) for the individual decision maker. Moral hazard is shown to be a binary decision problem where; (1) the farmer produces at the social optimum if crop insurance does not create the incentive to manage poorly, or (2) the farmer applies the minimal level of inputs to ensure crop insurance eligibility and collects the appropriate indemnity. This is shown to be a problem which depends significantly on the situation of the individual decision maker. In any case, when moral hazard occurs, substantially reduced levels of input use are the result.

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[37] Providing that crop insurance does not provide incentives for moral hazard.

Unfortunately, the conceptual model does not yield many conclusions regarding land use, enterprise selection and technology adoption. Crop portfolio diversification will depend critically on how the crop insurance program affects the relative profitability and risk of each crop available to the decision maker. In comparison, how crop insurance affects land use will depend on the theory of land rent which maintains that land will be used in its highest and best use. Therefore, the extent to which crop insurance subsidizes a particular enterprise (i.e., grain), will determine whether land use is affected on the margin. With respect to extended cropping, one must compare the net benefit of crop insurance for stubble crops to that for summerfallow crops. If stubble cropping receives a greater net benefit from crop insurance, then one can conclude that it encourages extended cropping at the margin.

One can see that each of the conclusions reached in the above paragraph is conditional upon the situation of the farmer with respect to land type, climate, and growing season conditions. Therefore, we cannot make any broad based conclusions using the theoretical approach. Instead, we use the conclusions above as a basis for testing hypotheses in the empirical work to follow.

On other farm management decisions like major enterprise selection (i.e., grain versus livestock) or technology adoption, the theoretical model provides little or no hypotheses to test. Decision making models of the nature necessary to address these decisions are extremely complicated and often intractable because of the many factors involved. Therefore, to determine what the final implications of insurance are on these major enterprise decisions, one must rely on actual observation of farm management decisions in the context of a farm system rather than how it affects an individual unit of production like land.[38] That is the purpose of the chapters to follow.

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[38] A complicated farm system portfolio model may more accurately reflect the economics of major enterprise and technology use decisions. In any case, empirical analysis is crucial to examine these major questions. In addition, empirical analysis is important because many of the implications of the conceptual model contrast with one another (i.e., input use and crop selection).

CHAPTER III

SURVEY DESIGN AND INFLUENCES OF CROP INSURANCE ON FARM MANAGEMENT DECISIONS

3.1 Introduction

In Chapter II, the theoretical implications of producer response to a crop insurance program were examined. The results of the conceptual model provide a number of hypotheses that can be tested. In particular, it would be interesting from an empirical perspective to test the conclusions of the theoretical model by examining how crop insurance affects (1) variable input use, (2) crop selection, (3) land use, and (4) technology adoption. Therefore, the purpose of this chapter is to explain the data that will be used to test many of these hypotheses.

The chapter begins with a discussion of the rational behind the design of the farm survey. This discussion elaborates on the methods used to develop the sample of producers as well as a discussion of the areas surveyed. The third section illustrates some of the more general sample characteristics of each of the surveyed regions. Included as part of the statistics shown are participation rates in crop insurance by region. The fourth section of the chapter examines producer's perceptions of crop insurance as a risk management tool. In particular, it illustrates the major reasons why producers may or may not carry crop insurance in each of the regions. Section five examines how crop insurance has influenced the farm management decisions of participators. This section may provide some empirical evidence for the inference made in Chapter II. The final section gives our conclusions.

3.2 Survey Design

It is well known that agricultural production in Saskatchewan has significant regional differences (Schoney, Thorson and Weisensel, 1988).[39] Therefore it seems likely that crop insurance will affect farmers in separate regions differently. To incorporate these possible differences, the farm survey was conducted in four regions. These regions were broken down to include a low and high land quality area in the brown and black soil zones. Based on the above criteria, the four regions selected are listed below:

(1) Chaplin-Central Butte
(2) Moose Jaw
(3) Melfort
(4) Meadow Lake

Each of the regions are outlined in the map in Figure 3.1. Names of the population of farmers in each of these areas were collected from rural municipality maps based on the location of their home quarters. The names were then matched with addresses collected from appropriate telephone directories.[40] In addition, the Saskatchewan Crop Insurance Corporation provided us with names and addresses of farmers who participated in the 1988 program for each of the areas. Names were randomly selected from the lists to make up the survey sample. The goal was to survey approximately 60 farmers from each of the four regions. The survey was divided up into

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[39] Traditionally, the agricultural region of Saskatchewan has been divided into three climatic zones known as the brown, dark brown, and black soil zones. The brown soil zone corresponds to the southwestern corner of the province where rainfall is most limiting. The black soil zone is in the northeastern region of the grain belt and receives the greatest amount of precipitation. The dark brown soil zone falls between the black and brown soil zones.

[40] Those names which could not be matched with address were deleted from the list.

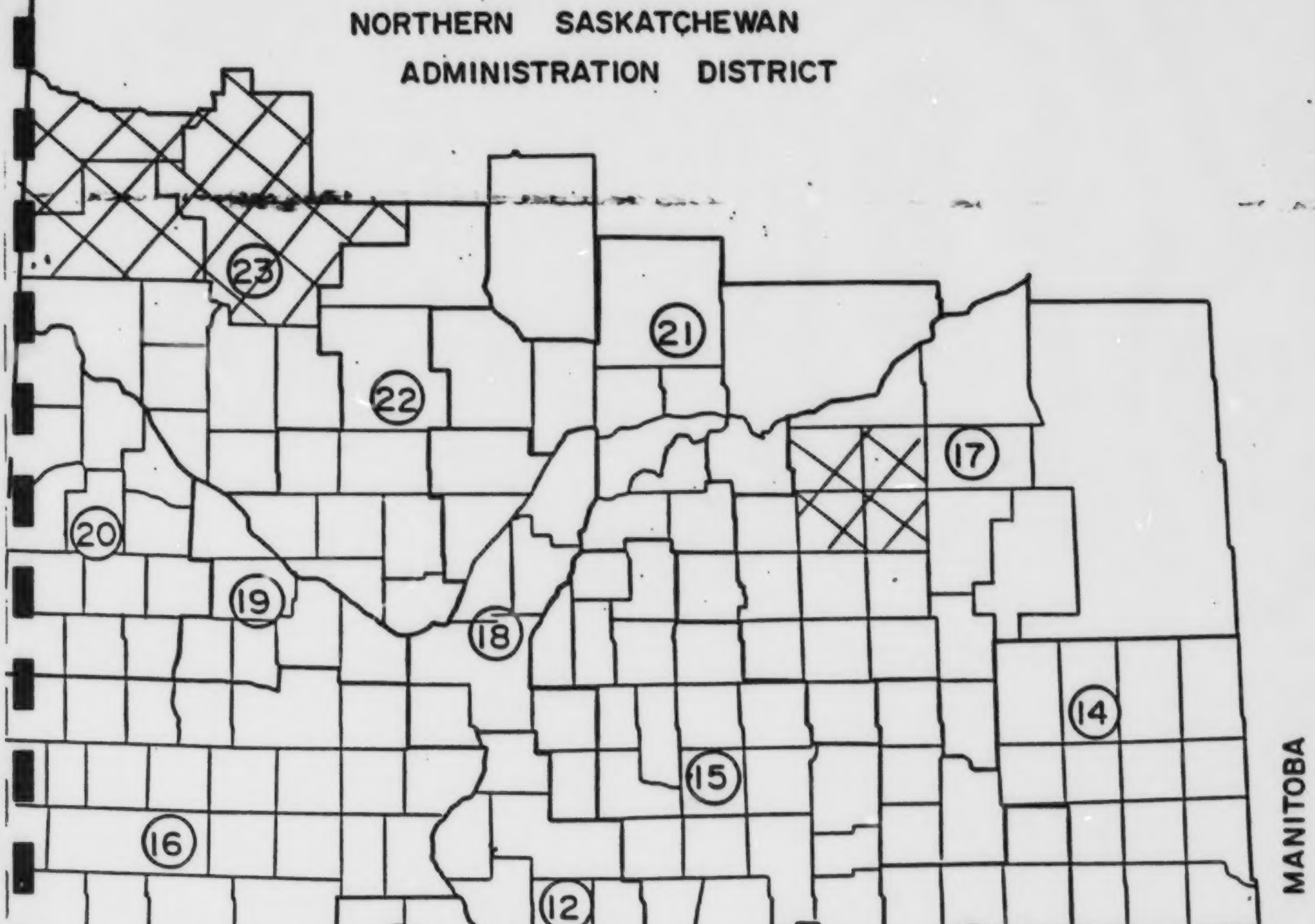
NORTHERN SASKATCHEWAN
ADMINISTRATION DISTRICT
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
MANITOBA
MONTANA
N. DAKOTA

FIGURE 3.1 LOCATION OF SURVEYED REGIONS

five basic sections.[41] The first section collected socioeconomic data about the operator, his family and the financial condition of the firm. This section included questions to determine the size and type of farm being operated. All farmers surveyed were asked the questions from section one.

The second section of the survey elicits general information regarding a farmers participation in crop insurance. Specifically, its purpose is to indicate whether the farmer is currently, or ever has participated in the crop insurance program. Therefore, this section branches farmers into three different groups depending on their level of participation in crop insurance. We define the three groups here as (1) continuous participators, (2) selective participators, and (3) non-participators. Continuous participators are defined as those producers who have been on the program continuously from the time they started to the present. In addition, we maintain that the producer had to participate prior to the 1989 crop year.[42] Selective participators are defined as those individuals who participate in selective years or selective acres. These producers participate in those years when they are more likely to receive indemnities or for those crops which they are more likely to receive indemnities.[43] Finally, non-participators are defined as those individuals who have never participated in crop insurance or those who participated in 1989 but never plan on participating again. An additional purpose of this section was to determine the main reasons why farmers did or did not participate in the crop insurance program.

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[41] A copy of the survey can be found in the Appendix.

[42] There is an important reason for this caveat. The level of participation in crop insurance increased dramatically for the 1989 crop year. Based on the interviews, we contend that a large percentage of this substantial increase was based on two factors acting together. First, the spring of 1989 had to be considered as one of the driest, in terms of spring available soil moisture, on record in most parts of the province. Second, the Federal government advertisement campaign against ad hoc agricultural support like the Special Canadian grains program started rumours in the agricultural community that all future agricultural support programs would be tied to whether a farmer participated in the All Risk Crop Insurance program. Many farmers who purchased crop insurance for the first time in 1989, indicated that this was their main reason for participating.

The third section of the survey evokes more specific information about a farmers participation in crop insurance. In addition, it elicits yield distributions for the most important crops grown on the farm.[44] Finally, it asks both participators and non-participators their willingness to pay for the 1989 crop insurance program.

The fourth section questions a producer about his basic farming practices. It includes questions about input use, possible land clearing and other agronomic practices. All participants answer this section of the survey. Its purpose is to test whether there are differences between the way participators and non-participators farm their land.

The final section of the survey asks the producer for his own input into how he or she would like to see the crop insurance program improved or changed. All answers are open ended so the data in this section does not lend itself well to statistical testing. However, this section should provide some valuable information regarding possible changes and new ideas.

A team of five interviewers went into each of the four areas. Each of the interviewers were given training regarding basic interviewing techniques and were well versed in the objectives of the questionnaire. All the interviewers were extremely familiar with Saskatchewan agriculture and the Saskatchewan All Risk Crop Insurance Program.

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[43] Many farmers who use crop insurance for selective crops indicate that crop insurance is not a worthwhile investment for the crops they do not insure (see equation 2.8).

[44] Yield distributions were elicited using the percentile based beta distribution approach (Young, 1983).

A total of 243 interviews were conducted over the period of July 17th to August 18th 1989. In each of the areas several farmers refused to be interviewed. The rate of refusal was highly correlated with the intensity of livestock in a given area. The timing of the survey was somewhat inconvenient since haying operations were in full swing during the survey period. Only 10 farmers refused us outright because they were disgusted with the crop insurance program and felt the survey process was useless. Refusals of this type occurred most frequently in the southern areas where 7 farmers gave negative responses.

3.3 Sample Characteristics by Region

The purpose of this section is to illustrate some of the basic farm data collected. Tables 3.1 through 3.4 illustrate the summary statistics of each region for;

(1) farmer age,

(2) farm size,

(3) the percentage of gross income contributed by livestock operations,

(4) level of high school education,

(5) farm solvency (debt/asset ratio), and

(6) the proportion of sample farmers who participate in crop insurance.

When one compares and contrasts the results in Tables 3.1 through 3.4, several interesting observations can be made. The average age of farmer is stable across the four regions at around 46 years of age.

Table 3.1: Sample Characteristics of Chaplin-Central Butte Region

# of observations = 65

Statistic	Age	Total Acres	Cult. Acres	Pasture	Gross % Livestock	H.S. Educ.	Debt/Asset Ratio
Mean	45.39	2179	1543	557	0.27	10.73	0.25
Std. Dev.	13.42	1726	1130	926	0.25	1.59	0.25
Minimum	23	320	280	0	0	8	0
Maximum	75	9800	6300	5000	0.9	12	0.825

	Part.	Non Part.	Selective	Livestock
Proportion	63.8%	10.3%	25.9%	63.8%

Table 3.2: Sample Characteristics of Moose Jaw Region

# of Observations = 65

Statistic	Age	Total Acres	Cult. Acres	Pasture	Gross % Livestock	H.S. Educ.	Debt/Asset Ratio
Mean	47.09	1437	1320	64	0.08	11.09	0.15
Std. Dev.	12.67	1013	983	151	0.18	1.26	0.18
Minimum	26	0	0	0	0	7	0
Maximum	74	5940	5800	660	0.65	12	0.75

	Part.	Non Part.	Selective	Livestock
Proportion	73.8%	6.2%	20.0%	21.5%

Table 3.3: Sample Characteristics of Meadow Lake Region

# of observations = 60

Statistic	Age	Total Acres	Cult. Acres	Pasture	Gross % Livestock	H.S. Educ.	Debt/Asset Ratio
Mean	47.97	1215	943	254	0.30	9.29	0.30
Std. Dev.	13.24	1040	858	413	0.33	2.34	0.36
Minimum	25	0	0	0	0	3	0
Maximum	75	5000	5000	1950	1	12	1.5

	Part.	Non Part.	Selective	Livestock
Proportion	38.3%	36.7%	25.0%	60.0%

Table 3.4: Sample Characteristics of Melfort Region

# of observations = 60

Statistic	Age	Total Acres	Cult. Acres	Pasture	Gross % Livestock	H.S. Educ.	Debt/Asset Ratio
Mean	46.87	1135	1011	42	0.07	11.05	0.35
Std. Dev.	12.99	686	655	88	0.14	1.58	0.44
Minimum	24	0	0	0	0	7	0
Maximum	82	4160	3800	580	1	12	2

	Part.	Non Part.	Selective	Livestock
Proportion	41.7%	20.0%	36.7%	26.7%

Average farm size is greater in the two southern regions than in the two northern regions. In addition, farm size is greater in the lower land quality regions than it is in the high quality land regions for both the northern and southern areas. In fact, when one compares Chaplin-Central Butte to Moose Jaw, one can see that even on the basis of cultivated acres, farms in the Chaplin-Central Butte region tend to be larger. One could expect this intuitively since it takes larger farms to support a family unit on land of lower quality.

Another interesting and intuitive result illustrated in the Tables reflects the distribution of livestock by area. Livestock tends to be a much more important component of the agriculture sector in the regions with lower and less homogeneous land quality (Chaplin-Central Butte and Meadow Lake). This coincides with the fact that on average farms in each of these areas tend to have a substantial number of acres in permanent pasture or hay.

From an agricultural insurance perspective, it appears that livestock may be an important component in determining an individuals participation in crop insurance. Note that in both the northern and southern areas, the proportion of farmers who participate in crop insurance is indirectly correlated with the proportion of farmers who produce livestock.

The Tables also tend to support the hypothesis that moral hazard and adverse selection may be substantial problems with the Saskatchewan All Risk Crop Insurance Program. Selective participators are a substantial proportion of the farmers surveyed in each of the four regions. Obviously, selective users of crop insurance use it when they see it as being a benefit to them. It is likely that they join the program when they have substantial soil moisture deficits (adverse selection).

3.4 Perceptions of Crop Insurance as a Risk Management Tool

The purpose of this section of the chapter is to illustrate the reasons why an individual farmer is a participator or non-participator in the Saskatchewan crop insurance program. In addition, this section ranks the major reasons which induces a selective participator to join the program in selective years or acres.

We begin this analysis by examining the major reasons why producers participate in crop insurance. Table 3.5 illustrates the statistical results associated with question 2.1.3 of the farm survey for each of the regions (see Appendix A.1). Basically the producer was asked to indicate the importance of the following factors in their decision to participate in crop insurance:

(1) They purchase it for hail insurance (HAIL).

(2) They purchase it for drought insurance (DROUGHT).

(3) They have a highly concentrated land base (CONC).

(4) To avoid the losses associated with crop pests (PEST).

(5) They were forced (persuaded) to participate by a lending institution to get operating credit (BANK).

(6) They participated because of their own concerns regarding their debt situation (DEBT).

(7) They purchase crop insurance to avoid the losses associated with an early frost (FROST).

The importance of each of the factors is recorded as a likert score where the scores 1, 2, 3, and 4, refer to unimportant, somewhat important, important, and very important, respectively.

Table 3.5: Important Risk Consideration in the Decision to Participate in Crop Insurance by Region.

RISK FACTOR	HAIL	DROUGHT	CONC	PEST	BANK	DEBT	FROST
REGION	CHAPLIN - CENTRAL BUTTE						
Mean	2.85	3.75	2.05	2.16	1.55	2.07	1.42
Std. Dev.	0.98	0.55	1.03	1.06	0.95	1.09	0.73
REGION	MOOSE JAW						
Mean	2.74	3.10	1.52	1.69	1.56	1.82	1.93
Std. Dev.	1.01	1.01	0.82	0.89	1.01	1.10	1.06
REGION	MEADOW LAKE						
Mean	3.05	2.66	1.61	1.74	1.95	2.00	3.24
Std. Dev.	1.15	1.18	0.90	0.96	1.26	1.17	0.98
REGION	MELFORT						
Mean	2.90	3.28	1.96	1.76	1.78	2.32	2.80
Std. Dev.	0.92	0.90	0.96	0.88	1.08	1.14	0.77

Source: Farm Survey

Overall, the results in Table 3.5 indicate that there is not a great deal of difference in the reasons for participating in crop insurance in different regions.[45] As expected however, it appears that frost is a greater concern in northern areas when compared to the southern areas. In addition, drought appears to be a less important concern in Meadow Lake than in the other regions. The relatively high value associated with the drought variable in the Melfort region is probably biased by the fact that the Melfort region was experiencing a serious moisture deficit at the time of the survey.[46]

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[45] None of the results are significantly different across regions.

Surprisingly, debt and insistence by lending institutions do not appear to be an overriding concern for producers participating in crop insurance. Generally, drought appears to be the most important factor followed by hail insurance and frost protection.

In addition to asking producers why they participate, question 2.2 of the survey asks non-participators why they do not participate.[47] Again, the same likert scoring mechanism is used to indicate the importance of each of the following factors in their decision to not participate. The first statement they were asked to rank is that the premiums are too high for the level of coverage offered (PREMIUM). The second is that crop insurance is not an effective risk management tool (TOOL). The third states that the producer does not like government involvement in agriculture (INVOLVE) and the fourth states that the stubble crop coverage relative to summerfallow is too low (LOW). Table 3.6 illustrates the statistical results of the question.

The results of this Table suggest that the most important reason for not participating is that premiums are too high for the level of coverage. This is exactly what the conceptual model of Chapter II predicts. Note that the importance of this factor increases as you move to the northern regions, however, none of the means illustrated in Table 3.6 are significantly different from a statistical standpoint. Interestingly, although not shown in the Table, many producers pointed out that they would be willing to pay premiums higher than the current premiums, provided higher yield coverage was available. Many of the producers, particularly those in the northern areas, felt that the coverage levels currently offered did not in any way reflect their own distribution of yield. They argued that their probability of collecting was zero.

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[46] This was their second poor year in a row. However, based on crop insurance data, the Melfort region has been the highest production area in the province. It is one of the only areas in the province where stubble and summerfallow yields are comparable.

[47] This question is presented to both non-participators and selective participators to determine why they don't participate.

As expected, the statement regarding stubble and summerfallow coverage appears to be more important in northern areas where stubble cropping is a more prevalent farm practise. In both of the northern areas, many farmers indicated that they perceived little difference between their summerfallow and stubble yields, yet they are covered at substantially different levels by the crop insurance program.

Farmers found the INVOLVE statement to be the least important of all. Generally speaking most producers would like less government involvement in agriculture, especially as it related to ad hoc programs. However, they are quick to admit that the support of the federal treasury over the past few years was an important contribution to their farm incomes.

Prior to completing the survey in each of the four regions little was known about the extent to which producers selectively used crop insurance.

Table 3.6: Relative Importance of Reasons for Not Participating

STATEMENT	PREMIUM	TOOL	INVOLVE	LOW
REGION	CHAPLIN - CENTRAL BUTTE			
Mean	2.67	2.40	1.67	1.80
Std. Dev.	1.25	1.40	1.01	1.17
REGION	MOOSE JAW			
Mean	3.00	2.50	1.93	1.64
Std. Dev.	1.31	1.30	1.28	1.23
REGION	MEADOW LAKE			
Mean	3.41	2.79	1.50	2.15
Std. Dev.	1.03	1.12	1.04	1.33
REGION	MELFORT			
Mean	3.43	2.57	1.87	2.15
Std. Dev.	1.05	1.26	1.23	1.18

Source: Farm Survey

However, the conceptual model of Chapter II indicates the possibility exists and Tables 3.1 through 3.4 seem to indicate that it is not an uncommon practice. Question 2.1.4.2 of the farm survey requests the producer to determine the importance of a number of statements in their decision to purchase crop insurance in selective years. The likert scoring mechanism is analogous to that used to calculate Tables 3.5 and 3.6. The statements they are asked to score are:

(1) the addition of newly rented or purchased land (NEW).

(2) soil moisture reserves are low (i.e. probability of drought is high) (MOIST).

(3) to protect against the risk of incorporating a new farm practice (PRACTICE).

(4) to protect against the risk of seeding a new crop variety (CROP).

(5) pricing options offered by crop insurance (OPTIONS).

(6) pest populations are high (PEST).

The summary statistics of the likert scores for each of the above statements are illustrated in Table 3.7.

Table 3.7: Important Variables in the Selective Insurance Decision

VARIABLE	NEW	MOIST	PRACTICE	CROP	OPTIONS	PEST
REGION			CHAPLIN - CENTRAL BUTTE			
Mean	2.44	3.67	1.89	1.78	2.17	2.00
Std. Dev.	1.38	0.67	1.15	1.03	1.12	1.20
REGION			MOOSE JAW			
Mean	2.00	3.57	1.29	1.36	2.00	1.93
Std. Dev.	1.13	0.82	0.59	0.61	1.20	1.28
REGION			MEADOW LAKE			
Mean	1.46	2.15	1.62	1.46	1.92	1.50
Std. Dev.	0.93	1.35	1.00	0.93	1.14	0.87
REGION			MELFORT			
Mean	1.95	3.24	1.20	1.55	1.95	1.55
Std. Dev.	0.97	0.97	0.51	0.86	1.02	0.92

Source: Farm Survey

In each of the regions low soil moisture is by far the most important reason why a selective participator purchases crop insurance in any given year.[48] Interestingly, the price options offered by crop insurance are also an important determining factor in the decision to participate. Many producers indicated that it is not worthwhile to participate when market and crop insurance prices are low.

High pest populations as well as the addition of newly rented land appear to be marginally important in a selective producer's decision to participate. The incorporation of new farm practices or new crops does not appear to be an important consideration.

The results of Tables 3.5 through 3.7 explain some of the important components of the decision to participate in crop insurance. Interestingly, the most significant factors in the decision to purchase crop insurance, as indicated by the conceptual model of Chapter II, also seem to be the most important statistically, based on producers perceptions. However, none of the results revealed in this section provide any evidence regarding how a producer's participation in crop insurance affects his farm management decisions. The next section deals with these issues by asking participators about some of their farm management decisions.

3.5 Crop Insurance: Perceived Impacts on Farm Management Decisions and Technology Adoption

In addition to the aggregate data in a second section of the farm survey, we obtained data about how participators feel crop insurance has influenced their farm management decisions. The purpose of this section is to discuss the results of these questions for each of the four regions.

One of the major concerns regarding crop insurance in Saskatchewan is how crop insurance influences the decision to stubble crop.[49] The first column of Table 3.8 (STUBBLE) indicates that crop insurance does influence some farmers' decisions to stubble crop.[50] However, crop insurance has a greater influence on the stubble cropping decision in the two southern regions. In the Chaplin-Central Butte and Moose Jaw regions, 10.0 and 14.7 percent of the continuous participators, respectively, stated that their participation in crop insurance increases the amount of land they stubble crop. Only one producer admitted this in the Melfort region while no producers were influenced in the Meadow Lake region. The differences in responses noted between the northern and southern regions is probably explained by the fact that stubble cropping is a more common and accepted practice in the north than in the south. Since the risk of stubble cropping in the south is greater than in the north, crop insurance has more impact where the risk is greater.

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[48] The importance of soil moisture is somewhat lower in the two northern regions. However, many selective participators in these areas insure selected crops not selective years. Therefore, moisture won't be as important.

The third, fourth and fifth columns of Table 3.8 refer to how crop insurance has influenced a participator's decisions regarding; (1) the number of crops seeded (CROPS), (2) the level of variable input use (VARINPUTS), and (3) their level of capital investment (INVEST). Each of the above decisions were rated by the participator using a likert scale where a response of 1 through 5 referred to markedly decrease, moderately decrease, no influence, moderately increase, and markedly increase, respectively.

Currently, the Saskatchewan Crop Insurance Program requires producers to insure the total production of a particular crop across the whole farm unit. Consequently, it is argued that many producers risk split their farm operations by seeding more crops to enhance their level of coverage. The results in Table 3.8 support these speculations. It is interesting ~~to note that~~ more than 12.0% of the participators in the two southern regions admit that crop insurance causes them to moderately or markedly increase the number of crops they seed. This compares to less than 4% of the participators who admit this in the two northern regions.[51] Generally, risk splitting within crop insurance in this manner does not appear to be an overriding problem. However, to the extent that it occurs, it may result in adverse selection.[52]

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[49] Soil Conservation Canada maintains that crop insurance reduces the incentive to stubble crop. In contrast, some maintain crop insurance increases the likelihood of stubble cropping and therefore distorts grain production in Saskatchewan.

[50] The proportion row for each region represents the percentage of farmers in the region who feel that crop insurance does increase the amount of land they stubble crop.

The conceptual model of crop insurance discussed in Chapter II indicated that risk averse producers would use more inputs with crop insurance than without it. The results in Table 3.8 support the conclusions of the conceptual model. In each of the four regions, the mean value of the response is slightly greater than 3.0.[53] Again, it is interesting to note that more participators in the south responded positively to this question than participators in the north. This is surprising since variable costs of production in the north are much greater than in the south (Schoney, Thorson and Weisensel, 1988). Theoretically, one could explain this result if crop insurance reduces income variability less in the north than in the south (see equation (2.8) and the discussion following it). Based on the discussions with producers in northern areas, they regard crop insurance as a worst case scenario. Even if they do collect an indemnity, it doesn't come close to covering their variable costs of production.[54] In contrast, crop insurance coverage in southern areas will cover the variable costs of crop production.

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[51] This is a rather surprising result when one considers that northern producers have more crop options than southern farmers. The proportion row indicates the proportion of producers which feel crop insurance has had a positive impact upon CROPS, VARINPUTS, INVEST and FIELDS.

[52] Changes in crop selection resulting from crop insurance may not be serious from a social perspective, providing it doesn't result in a selection of crops which lowers societal welfare below where it would be without crop insurance.

[53] The row denoted proportion represents the percentage of participators who indicated that they either moderately or markedly increased their variable input use with crop insurance.

Table 3.8: Impacts of Crop Insurance on Farm Management Decisions

DECISION	STUBBLE	CROPS	VARINPUTS	INVEST	FIELDS	PRACTICE	INPUTS	CROPS	LIVESTOCK
REGION	CHAPLIN - CENTRAL BUTTE								
Mean	NA	3.13	3.09	3.17	1.44	NA	NA	NA	2.11
Std. Dev.	NA	0.34	0.29	0.38	0.84	NA	NA	NA	0.32
Proportion	10.0%	12.0%	10.0%	18.0%	24.0%	4.0%	10.0%	4.0%	0.0%
REGION	MOOSE JAW								
Mean	NA	3.16	3.05	3.11	1.77	NA	NA	NA	2.03
Std. Dev.	NA	0.41	0.22	0.37	1.17	NA	NA	NA	0.25
Proportion	14.7%	14.7%	4.9%	9.8%	34.4%	0.0%	3.3%	8.2%	1.6%
REGION	MEADOW LAKE								
Mean	NA	3.00	3.03	3.00	1.14	NA	NA	NA	2.00
Std. Dev.	NA	0.00	0.16	0.00	0.42	NA	NA	NA	0.00
Proportion	0.0%	0.0%	2.8%	0.0%	13.8%	2.8%	2.8%	0.0%	0.0%
REGION	MELFORT								
Mean	NA	3.06	3.06	3.14	1.16	NA	NA	NA	1.98
Std. Dev.	NA	0.31	0.31	0.40	0.50	NA	NA	NA	0.14
Proportion	2.0%	4.0%	4.0%	12.0%	10.0%	2.0%	4.0%	2.0%	2.0%

Source: Farm Survey

Agricultural development and stability are often noted as major benefits from a crop insurance program (Hazell, Pomareda and Valdes,

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[54] Particularly when market prices are low. This seems to support the contention that crop insurance does not reduce income instability in the north to the same degree as it does in the south.

1986). In Saskatchewan, this income stability could result in increased investment in machinery, equipment and other capital items. The INVEST column of Table 3.8 suggests that some participators are more likely to invest in capital expenditures. In the Chaplin-Central Butte region, 18 percent of the participators indicated that they invest more in their agricultural operations. This number falls somewhat in both the Melfort and Moose Jaw regions. None of the participators in the Meadow Lake region felt crop insurance had any influence on their capital investment. Overall, many of the producers felt it was difficult to talk about capital investment in agriculture over the last few years. Poor commodity prices followed by poor crops have left many farmers in a position where new investment is unthinkable.

Another method of risk splitting a farm operation using crop insurance is to carefully select the fields a producer allocates to the seeding of specific crops. One example of this phenomena is a farmer who has two or more tracts of land which are located in geographic or climatically different regions.[55] In order to maximize his coverage this producer will seed different crops in each region so low yields in one region will not be offset by high yields in another region. The FIELDS column in Table 3.8 reflects the results of whether participators feel crop insurance influences the fields they allocate to specific crops. The likert scale used to measure the importance of this factor ranks from 1 to 4 to represent no influence, small influence, moderate influence, and major influence, respectively. Overall, the field allocation question is the most important factor of all those shown in Table 3.8. Field allocation is more important in the southern than in the northern region.[56] In the southern areas, roughly 30% of participators indicate that crop insurance has at least a small influence on the fields they allocate to specific crops. This number drops to around 12% for the two northern areas. One possible explanation for this discrepancy may be that northern farms tend to have smaller more concentrated land bases than southern farmers (Tables 3.1 through 3.4). Therefore, risk splitting in the manner described above may have less benefit to a northern producer.

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[55] One weather pattern (drought, etc) is unlikely to affect the separate regions in the same way. It is more likely that one of the areas will be a total loss while the other yields an average crop.

Technological advance has been an important factor in Saskatchewan agriculture. New crop cultivars, farm practices and inputs have resulted in increased production on the prairies. However, crop insurance is often criticized as a program which slows the adoption of new technology. The criticizers maintain that the institutional nature of crop insurance tends to mask economic and environmental signals thus encouraging the status quo rather than necessary change. The three columns denoted PRACTICE, INPUTS, and CROPS illustrate the results of questions which examined whether the crop insurance program had an impact upon the adoption of new farm practices, new inputs and new crops, respectively. The results in the Table show the proportion of producers by region who felt there was an impact. With respect to new farm practices (PRACTICE) and new inputs (INPUTS), producers pointed to crop insurance as encouraging their adoption because they were protected against the risk of a mistake associated with a new technique.[57] Some producers pointed out that they may not have purchased an airseeder had it not been for crop insurance.

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[56] The proportion row for each region refers to the number of participators who indicated that crop insurance has even a small influence on the fields they allocate to specific crops.

[57] Note that this component of technology adoption is less significant than the introduction of new crops (CROPS).

In contrast, the seeding of new crops appeared to be more significantly affected and in an opposite manner when compared to new inputs and new farm practices. Each producer that pointed out the influence maintained that they were less likely to seed a new (usually specialty) crop because (1) the coverage was too low, or (2) no coverage existed. For example, in the Moose Jaw region a couple of producers pointed out that lentils had poorer coverage than spring wheat, yet lentils are likely more drought resistant (less risky) than wheat in that area.[58] Again, based on the results of the Table the influence of crop insurance on technology adoption is more prevalent in the south than in the north. However, overall it does not appear that crop insurance has slowed down technology adoption.

The final column of Table 3.8 provides the results to the question of how crop insurance participators view livestock as an alternative diversifying enterprise. There were three possible responses to this question with the numbers 1, 2, and 3 referring to a negative influence, no influence, and a positive influence, respectively. It is argued that crop insurance, which reduces the risk associated with grain farming, tends to discourage farm enterprise diversification into livestock. The results from this question are mixed and do not necessarily support the above hypothesis.[59] In fact, in some ways the results actually refute it since more producers felt crop insurance had a positive influence on their perception of livestock as an alternative enterprise than otherwise. For instance, six producers in the Chaplin-Central Butte region feel that crop insurance has a positive influence on their perception of livestock as an alternative farm enterprise while no producers felt it had a negative influence. The empirical results of Chapter IV will provide more insight into this result.

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[58] These producers pointed to the fact that a good lentil crop requires some heat stress to set seed.

[59] The proportion now represents the percentage of producers who maintain that crop insurance has a negative impact upon their perception of livestock as an enterprise.

3.6 Conclusions

The overall objective of this chapter was to examine two basic questions. The first was to explain the major reasons why producers may or may not participate in crop insurance. The second was to examine how participators in crop insurance felt the program was affecting their farm management decisions.

With respect to the first objective, it was found that drought insurance was the major reason for participation, although it was less important in northern areas. Hail insurance was the second most important reason. The main reason for non-participation was due to basic economics. Non-participators felt the premiums were too high for the level of coverage they were offered. Finally, low soil moisture at seeding time was found to be the single most important variable explaining the years when the selective participator joined the program.

Based on the perceptions of participators, farm management decisions do not appear to be affected dramatically by the crop insurance program. However, risk splitting by increasing the number of crops grown and carefully selecting the fields allocated to specific crops are fairly frequent practices, particularly in the two southern regions. Generally speaking, crop insurance tended to have a greater influence, as perceived by producers, on decision making in the two southern regions. One possible explanation for this difference is that the crop insurance program is more lucrative and therefore has a greater influence in the south. However, this is an empirical question which will be dealt with more thoroughly in Chapter V.

With respect to some of the other management practices examined, it appears from a perceptional perspective that crop insurance has some marginal influences. For some producers it led to increased stubble cropping, greater input use and increased capital investment. However, these results should be treated with caution. For instance, the fact that some producers feel that they use more inputs with crop insurance does not mean that participators use more inputs than non-participators. None of the results in this chapter address those questions. They only show how participators perceive that they have been affected. Comparisons of the farm practices of participators, non-participators and selective participators is the objective of the next chapter.

CHAPTER IV

PARTICIPATORS AND NON-PARTICIPATORS IN SASKATCHEWAN ALL-RISK CROP INSURANCE

4.1 Introduction

The results discussed in Chapter III provide some insight into the reasons why producers may or may not participate in crop insurance. In addition, they provide some insight into some of the implications that crop insurance has on farm management decisions. Unfortunately though, the results presented there do not provide information on the characteristics of participators, non-participators and selective participators. Furthermore, they give no data on how crop insurance participators farm their land relative to other producers who do not participate or selectively participate. Basically, the results of Chapter III tell us how a producer's farm practices change once they become a participator.[60]

The objectives of this chapter are twofold. First, we examine and distinguish between the characteristics of producers who do and do not participate in crop insurance. This examination will concentrate on farm structural variables like farm size, major enterprises, family structure and the manager's level of education. Second, we examine differences in farm practices between participators, non-participators and selective participators. The focus will be to compare actual farm practices like rotations, input use and seeding decisions to determine if differences exist between groups. This analysis provides a natural extension to the results illustrated in Chapter III.

The second section of this chapter describes the statistical model and methods used to meet the two objectives outlined above. The third section illustrates and discusses the results of the comparison of farm structural variables. The fourth section discusses the results of the comparison of farm practices.

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[60] The results of Chapter III do not even tell us the bench mark from which a producer's practices have changed after crop insurance participation.

4.2 Statistical Model and Method of Analysis

In order to analyze the differences between participators and non-participators in the crop insurance program, a probability model is employed. The functional form of the probability model is the cumulative normal distribution and is known as the probit qualitative response model (Judge et al, 1982). In qualitative dependent variable models of this type, the dependent variable is a binary random variable Y_i that takes the value of 1 if the individual has made one choice and 0 otherwise. The estimated model has the following form:

$$V = XB + U \tag{4.1}$$

where, V is a Vector of "observed" probits (binary dependent variable), X is the matrix of explanatory variables, B is the vector of coefficients which explain how the independent variables impact upon the binary dependant variable and U is a vector of errors with $E(U) = 0$ and $\mathrm{Cov}(U) = \phi$.[61]

The vector of coefficients B is estimated iteratively by maximizing the likelihood function. The maximum likelihood estimator of B, $\hat{B}$, is consistent, asymptotically efficient, and asymptotically normally distributed (Judge et al, 1982). Consequently, the standard errors and thus the test statistics (t statistics) have asymptotic justification

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[61] For a more detailed accounting of the probit model, the reader is referred to Judge et al. (1982).

only.[62] Therefore, considerable caution should be used in their interpretation.

In Chapter III, we found that grain producers can be divided into three separate groups when evaluating their participation in crop insurance. These three groups are: continuous participators, non-participators, and selective participators. Therefore, in the analysis of each of the regions, two probits will be performed. The first will examine the differences in all participators and non-participators with selective participators grouped in with participators. A participator's dependent variable is 1 while a non-participator's is 0. The second probit is performed over the truncated sample of continuous and selective participators. In this probit, the selective participator is assigned a value of 1 while the continuous participators are assigned 0. Therefore, this second probit will examine if there are significant differences in the farm characteristics and practices of selective participators in the group of all participators. We begin the analysis with the evaluation of crop insurance participation and farm structural characteristics.

4.3 Crop Insurance and Farm Structural Variables

This section determines whether one can discriminate between different participators on the basis of farm structural variables. In this analysis, farm structural variables can be separated into the following 4 basic categories: farm size, landbase makeup, major enterprises, and farm manager and family characteristics. A list of the variables included in the probit analysis is provided below:

PAR is a dummy variable which is equal to 1 if the operator is a partner, 0 otherwise.

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[62] They are asymptotically correct for large samples.

INCORP is a dummy variable which is 1 if the operator is incorporated and 0 otherwise.

EXPER or AGE represent farm experience and age in years respectively. These two are highly correlated so they do not occur together in any regression.

TOTACR represents the total acres of the farm operation. It includes owned, leased and uncultivated land.

CULTRAT is the ratio of cultivated acres to total acres.

OWNRAT is the ratio of owned acres to total acres.

TOTLEA is total acres leased in an operation.

LIVEINC is the percentage of gross income attributable to livestock.

LDUM is a dummy variable which is 1 for producers with livestock and 0 otherwise.

HSCH is the total years of school education (12 is the maximum).

POSTHSCH represents the total years of post secondary education. It includes both university and technical school training.

DEPEND represents the farm operator's total number of dependents.

OFFFARM is a dummy variable which is equal to 1 for operators who earn off farm income and 0 otherwise.

SPOUSEOFF is a dummy variable which is equal to 1 if the spouse earns off farm income and is 0 otherwise.

DEBT represents the solvency ratio of the farm surveyed. It is the ratio of total debt to total assets.

Each of the above variables was tested for statistical significance in the probit models for each region. Those variables which were not significantly different from zero at a 30% level of confidence were removed from the model.[63] The results of the two probits for the Chaplin-Central Butte region are illustrated in Table 4.1 below.

Table 4.1: Explaining Participation by Farm Structural Variables - Chaplin-Central Butte Region

Dependent Variable	All Participators	Selective Participators
CONSTANT	-2.32 (-1.49)	0.30 (0.37)
AGE	0.09* (2.07)	----- -----
LDUM	1.47 (1.58)	-0.63 (-1.30)
TOTACR	-.00044* (-2.66)	0.0003* (1.75)
POSTHSCH	----- -----	0.36* (2.10)
DEPEND	0.390* (1.73)	-0.29* (-1.79)
OFFFARM	----- -----	-0.81 (-1.33)
OWNRAT	----- -----	-1.22 (-1.61)
OBSERVATIONS	63	57
CASES CORRECT	58	42
LOG LIKELIHOOD	-9.26	-26.23
AVG LIKELIHOOD	0.86	0.63

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[63] The variables were removed in a stepwise manner one at a time with the least significant variables going first. In addition to the level of confidence of any particular variable, changes in the log likelihood ratio was also a determining factor.

A number of variables are statistically significant in the probits illustrated above. AGE is positively and significantly (5% level of confidence) correlated with being in the all participator group. Therefore, older producers are more likely to be in crop insurance, perhaps suggesting that an individual's level of risk aversion increases with age. Within the group of all participators there was no statistical difference between the age of selective and continuous participators.

Farmers with livestock are more likely to be participators in crop insurance in this region. However, the results also suggest that selective participators are less likely to have livestock in their farm operation. This seems to refute the long held hypothesis that crop insurance reduces the incentive to diversify into livestock.[64] Alternatively though, one could argue that continuous participators, who are more likely to have livestock and insurance, are somewhat risk averse. Therefore, they seek and use every possible means to diversify their farm operation.

Farmers with larger total acreage are less likely to be continuous participators. This conclusion is based on the fact that TOTACR is negatively correlated with being in the all participator group but positively correlated with being a selective participator. Consequently, continuous participators in crop insurance appear to be smaller farmers.

A producer's level of education was unimportant in determining the difference between non-participators and all participators. However, the level of post secondary education (POSTHSCH) is significantly higher for the selective participators. This is an interesting result since it suggests that producers with higher education perceive a benefit to moving in and out of the program. Therefore, they believe crop insurance does not have a positive benefit to their farm operation for all crops in all years.

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[64] This is consistent with the results of Chapter III.

The farmer's number of dependants is positively correlated with being a participator but negatively correlated with being a selective participator. From a cash flow perspective this result is logical, since farms which support large families have higher cash flow needs. In addition, they are less able to weather the cash flow implications associated with a poor crop.

Producers with off-farm (OFFFARM) income are less likely to be selective participators. This is not too surprising since it is likely that the decision to participate in any given year takes time for consideration. It is quite likely that individuals who farm and work for a wage do not have the time to even consider this decision.

Finally, it appears that producers who rent a greater proportion of their land base are more likely to be selective participators. It is difficult to postulate a reason for this result. However, one could argue that the margin of profitability is lower for farms with more rented land.[65] Therefore, the decision to insure becomes much more critical from a cash flow perspective.

The results of the probit for the Moose Jaw Region are somewhat different than those just discussed from Chaplin-Central Butte (see Table

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[65] We are assuming here that the debt situation of the owner operator is reasonable.

4.2). In Moose Jaw, producers with livestock are less likely to be in crop insurance at all, but if they are a participator, they are more likely to be a selective participator. This result tends to confirm the hypothesis that participation in crop insurance tends to reduce the incentive to diversify into livestock. However, it contrasts with the results from the Chaplin-Central Butte region.

Table 4.2: Explaining Participation by Farm Structural Variables - Moose Jaw Region

Dependent Variable	All Participators	Selective Participators
CONSTANT	1.75 (3.77)	0.92 (1.23)
LDUM	-1.70* (-2.45)	0.79* (1.62)
OWNRAT	----- -----	-2.07* (-2.54)
OFFFARM	----- -----	-1.00* (-1.67)
DEBT	4.82 (1.01)	----- -----
OBSERVATIONS	63	59
CASES CORRECT	59	51
LOG LIKELIHOOD	-10.42	-24.93
AVG LIKELIHOOD	0.85	0.66

Interestingly, selective participators are more likely to lease a portion of their landbase. This concurs with the results from Chaplin-

Central Butte. Also concurring is the fact that participators with off-farm employment are more likely to be continuous as opposed to selective participators.

Finally, farm debt is positively correlated with being in the all participator group. One would expect this since producers with more debt as a percentage of assets have tighter cash flows. Therefore, poor years without insurance are more likely to result in loan default and farm foreclosure.

Table 4.3 illustrates the probit results on farm structural variables for the Melfort region. Again, it is interesting to note that participators in crop insurance in this region are more likely to have some livestock income.[66]

In Melfort, larger proportions of owned land relative to total land base are negatively correlated with being in the group of all participators. This is a slightly different result than in the two southern regions where OWNRAT was negatively correlated with being a selective participator. However, it is difficult to compare participators in these three regions since participation rates are substantially different.

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[66] This variable is not significant at a 10% level of confidence. However, the relationship is reasonably strong.

Table 4.3: Explaining Participation of Farm Structural Variables - Melfort Region.

Dependent Variable	All Participators	Selective Participators
CONSTANT	2.77 (2.20)	0.57 (0.44)
LDUM	0.81 (1.48)	----- -----
OWNRAT	-1.91 (-1.55)	----- -----
POSTHSCH	0.52* (1.92)	0.14 (1.03)
DEPEND	-.47 (-2.26)	
SPOUSEOFF	0.51 (1.05)	0.85* (1.92)
TOTACR	----- -----	.00044 (1.36)
HSCH	----- -----	-0.17 (-1.32)
OBSERVATIONS	53	43
CASES CORRECT	43	33
LOG LIKELIHOOD	-18.91	-25.93
AVG LIKELIHOOD	0.70	0.55

Post secondary education is also a significant variable in explaining producer participation. The results in Table 4.3 are consistent with those illustrated in Tables 4.1 and 4.2. The level of post secondary education is positively correlated with being in the all participator group. However, within this group we find a relatively strong result that selective participators are more highly educated than continuous participators.

Producers with spouses who have off-farm employment are more likely to be selective participators. If the ability to find off-farm employment is correlated with the spouse's level of education, then one could argue that this result is somewhat correlated with the fact that selective producers appear to have more education.

Similar to the other results reported, the size of farm and operator off-farm income appear to be positively and negatively correlated with being a selective participator, respectively. This seems to concur with the hypothesis that larger farmers who operate their farm full time are more likely to be selective participators.

Contrasting the result that selective participators have higher levels of post secondary education, is a second result which shows that producers with lower levels of high school education are more likely to be selective participators. This seems to indicate some interesting inferences about the level of education and farm business management.

Table 4.4 illustrates the probit results for the Meadow Lake region. Again, age appears to be positively correlated with being in the all participator group. In addition, it appears that producers with higher levels of high school education are more likely to be selective participators. In contrast, those with post secondary education are less likely to be participators.[67] Therefore, it appears that more educated producers tend not to participate or selectively participate.

The negative relationship between the amount of leased land and being a participator seems to compare closely with earlier results.[68] In addition, producers with higher debt appear to be more likely to participate in crop insurance. Therefore, reduced cash flow seems to be an important determinant in the decision to participate.

Larger farm families are more likely to be selective participators according the sign on the DEPEND variable. One could argue that larger families must be more careful in where they spend their cash income. Therefore, they only participate in those years or for those crops which have a positive expected value of insurance (see equation 2.8).

There seems to be no relationship between livestock income and whether a producer participates in crop insurance. In contrast though, within the group of participators, higher livestock income is positively correlated with being a selective participator. Finally, contrasting the results in the earlier Tables, larger farmers are less likely to be selective participators.[69]

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[67] This result is somewhat interesting since very few producers in the Meadow Lake area have post-secondary education. In Chapter III, we found that farmers in this area had the least education.

[68] In other regions, the ratio of leased land to total land was positively correlated to being a selective participator.

[69] However, this result is not highly significant statistically speaking.

Table 4.4: Explaining Participation by Farm Structural Variables - Meadow Lake Region

Dependent Variable	All Participators	Selective Participators
CONSTANT	-2.94 (-1.40)	-3.88 (-2.72)
AGE	.030 (1.31)	----- -----
HSCH	0.15 (1.20)	0.32* (2.23)
TOTLEA	-0.00058 (-1.27)	----- -----
POSTHSCH	-0.41 (-1.42)	----- -----
DEBT	0.80 (1.11)	----- -----
DEPEND	0.33* (1.93)	0.79* (2.41)
OFFFARM	-0.54 (-1.01)	-1.35 (-1.42)
TOTACR	----- -----	-.00063 (-1.40)
OBSERVATIONS	54	35
CASES CORRECT	40	28
LOG LIKELIHOOD	-29.44	-14.23
AVG LIKELIHOOD	.58	0.67

This section determines if continuous participators, selective participators and non-participators could be distinguished on the basis of farm structural variables. A summary of the results for each of the regions examined in the study presents some strong evidence that this is possible. Below is a discussion of some of the conclusions we have made from the analysis.

Continuous participators in crop insurance generally tend to be older farmers. In two of the four regions examined AGE was a significant variable in explaining farmer participation. Therefore, the common argument that older farmers are more risk averse, and therefore more likely to participate in crop insurance seems to be confirmed.[70]

In addition, continuous participators in crop insurance tend to have smaller farms than either selective or non-participators.[71] This seems plausible since the farm averaging provision of crop insurance means smaller farms get better coverage. They are less likely to have poor yields offset by better yields somewhere else.

A rather contradictory result is that participators in crop insurance are more likely to have livestock income. In two of four regions this was significantly and positively correlated with participation. Contrasting this result was the Moose Jaw region where it was negatively correlated. Therefore, this analysis has done little to settle the debate about whether crop insurance reduces the incentive to diversify the farm operation. One could argue that the results presented above are biased by the fact that in two of the four regions examined, livestock (cattle) is an extremely important enterprise.[72]

Family size, in terms of the number of dependents, is positively correlated with being a continuous participator in crop insurance. As explained earlier, larger families require large cash flows. Therefore, crop failure without insurance can cause extreme hardship.

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[70] Older farmers have less time before retirement to make up for reduced income or wealth.

[71] The only exception to this was for selective participators in the Meadow Lake region. However, this result was not significant at a 10% level of confidence.

[72] This is mainly due to the prevalence of cheap pasture land in the Chaplin-Central Butte and Meadow Lake regions.

Farm debt appears to be a marginal factor in explaining a producer's participation in crop insurance in two of the four regions. This was also one of the conclusions of the perceptional analysis performed in Chapter III, where debt was a less important factor than the pure economics of the insurance decision. Therefore, it appears like the expected value of insurance plays a more important role in the insurance decision than does debt.

As pointed out earlier in Chapter III, it was somewhat surprising to find selective participators to the extent that we did. Therefore, from a policy perspective, it is important that we know the characteristics of this group of producers. The results in Tables 4.1 through 4.4 suggest that selective producers are more educated and tend to have larger farms. In addition, they are less likely to have off-farm employment, and are more likely to have a substantial amount of leased land as part of their land base. Therefore, they are full time farm managers who appear to be expanding their land base beyond what they own. This, combined with the knowledge that they are more educated, suggests that this group may be more aggressive managers. Just the fact that these producers make this decision (to participate) on an annual basis may say something about their intensity of management.[73] The next section on farm practices provides more information to corroborate or nullify this hypothesis.

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[73] In Chapter III we found that they use additional information like spring available soil moisture in making their decision to participate.

4.4 Crop Insurance and Farm Practices

A common complaint regarding the Saskatchewan All-Risk Crop Insurance program is that it adversely effects farm management practices. The purpose of this section is to determine whether there are significant differences in the farm practices between continuous participators, non-participators and selective participators. A list of all the variables tested in the farm practice probit models is provided below:

ACRBROK represents the number of acres the producer has broken, cleared or drained since 1972

SFERT represents the total amount in $/acre spent on the fertilization of spring wheat on stubble.

FFERT represents the total amount in $/acre spent on the fertilization of spring wheat on fallow.

PERFALL is the ratio of summerfallow to total acres in the producer's rotation.

FUT is a dummy variable which is 1 if the producer uses future markets and 0 otherwise.

FCHEM and SCHEM represent expenditures on herbicides ($/acre) for spring wheat seeded on fallow and stubble, respectively.

FOR is a dummy variable which is 1 if the producer forward contracts some of this production and 0 otherwise.

HAIL represents the total amount in $/acre that the producer normally spends on hail insurance for spring wheat.

SB is a dummy variable which is 1 for farmers who maintain shelterbelts on their farm operations.

ST is a dummy variable which is 1 for farmers who use stubble snow trapping to conserve greater soil moisture.

CF is a dummy variable which is equal to 1 for producers who employ chem-fallow as opposed to regular fallow in their farm operations.[74]

SCROP is a dummy variable which is equal to 1 for farmers who strip crop, and 0 otherwise.

LEGROT is a dummy variable which is equal to 1 for farmers who seed a legume in their farm crop rotation and is 0 otherwise.

SEEDWHT is a variable which measures the producer's preferred time to seed spring wheat. Larger values of this variable imply later preferred seeding times.

LATEWHT represents the latest possible date that the producer would consider seeding spring wheat. This variable is measured as the number of days past May 1. Therefore, June 14 means LATEWHT has a value of 45.

CROPNUM is an integer variable which is calculated as the number of crops the producer seeded in the spring of 1989.

YSWF or YDURF represent the producer's expected yields of spring wheat or durum on fallow respectively.

YSWS represents the producer's expected yield of spring wheat on stubble.

CUSWF or CVSWS represent the coefficient of variation for spring wheat yields on fallow and stubble, respectively.[75]

STUBDUM is a dummy variable which is 1 if the producer stubble crops and 0 otherwise.

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[74] Chem-fallow is the current alternative to regular fallow to alleviate the problem of soil erosion. It involves the use of herbicides rather than tillage to control weeds during a summerfallow period.

[75] The coefficient of variation (CV) of yields is the ratio of the standard deviation of yields to the mean. Therefore, higher CVs indicate higher risk relative to the mean. Expected yields and standard deviation of yields are calculated from the triangular distributions in the survey. See Young (1983) to ascertain the methodology.

The same stepwise technique was used to determine when a variable should be removed from the model.[76] The results of the two probits for the Chaplin-Central Butte data is illustrated in Table 4.5.

The only variable which is even somewhat significant in explaining differences between the all participator group and non-participators is that participators are willing to seed wheat at a later date. At the crop insurance review meetings held this summer in Saskatoon and Regina, Soil Conservation Canada pointed out that the June 20 seeding deadline provided incentives for late seeding. The result in Table 4.5 seems to support this view.[77]

With respect to the selective producers, the results suggest that they are more likely to strip crop, have lower coefficient of variation of fallow spring wheat yields, spend less on chemical herbicides and are more likely to seed specialty crops like peas or lentils. Interestingly, all of these results tend to suggest that selective participators are better managers. The fact that they are more likely to strip crop indicates their concern and action to combat soil erosion. In addition, a lower coefficient of variation on yields indicates that their production is higher and less variable than for other producers. This may be another reason why they do not find it profitable to always participate (adverse selection). Their lower herbicide cost combined with the low coefficient of variation indicates that they are producers who farm efficiently by carefully controlling their weed problems. Finally, they are innovative since they are more likely to be seeding specialty crops.

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[76] The only exception is in cases where the removal of a variable adversely effects the log likelihood ratio. Otherwise, a confidence level of 30% was required.

[77] Note that selective participators are less likely to seed late when compared to the group of continuous participators.

Table 4.5: The Impact of Crop Insurance on Farm Practices - Chaplin-Central Butte Region

Dependant Variable	All Participators	Selective Participators
CONSTANT	-0.53 (-.66)	2.81 (1.99)
LATEWHT	0.027 (1.12)	-0.037 (-1.35)
SCROP	----- -----	0.66 (1.46)
CVSWF	_____ _____	-5.07* (-2.09)
FCHEM	----- -----	-0.12* (-1.86)
SPECROP	----- -----	1.28 (1.26)
OBSERVATIONS	56	54
CASES CORRECT	51	41
LOG LIKELIHOOD	-16.18	-25.33
AVG LIKELIHOOD	0.75	0.63

Unfortunately, the probit comparing all participators to non-participators in the Moose Jaw region could not be estimated. Since the number of non-participators (see Table 3.2) was so low, it was impossible to get the probit to converge for any combination of explanatory variables. Therefore, we will concentrate on the differences between continuous and selective participators since no statistical differences exist between non-participators and the group of all participators (see Table 4.6).

In the Moose Jaw area, selective participators tend to spend more on herbicide applications when seeding wheat but are less likely to use chem-fallow as a replacement for regular fallow.[78] Recent research at the university suggests that chem-fallow is not as profitable as regular fallow for soils of average soil quality (Weisensel, 1988). Therefore, it appears that selective participators are not as likely to trade off profits for increased soil quality when compared to continuous participators (Van Kooten, Weisensel and Chinthammit, 1990).

In addition, it appears that selective participators have higher expected yields for spring wheat on fallow.[79] In contrast to the statistical result that selective participators have higher expected yields, is the fact that they tend, as a group, to use less fertilizer when they seed spring wheat on fallow. However, they are more likely to have a legume in their rotation which could in part explain their lower commercial fertilizer use.

Farm practices change dramatically when one moves from southern lower rainfall regions to northern higher rainfall regions. One of the major differences in farm practices between the north and south is the importance of stubble cropping. Therefore, the results in Table 4.7 and 4.8 will reflect the characteristics of the different farm practices.

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[78] There may be a correlation between employing chem-fallow and dollars spent on herbicides the following year (residual effect). This would explain the lower herbicide costs of full participators who use chem-fallow more frequently.

[79] To keep the number of missing observations to a minimum, spring wheat on fallow was the only crop tested in the southern regions. Almost all farmers in these areas seed spring wheat on fallow.

Table 4.6: The Impact of Crop Insurance on Farm Practices - Moose Jaw Region

Dependent Variable	All Participators	Selective Participators
CONSTANT	NOT A	-3.13 (-1.63)
FCHEM	V A	0.0854* (1.50)
CF	I	-0.99* (-2.13)
YSWF	L A	0.075 (1.30)
FFERT	B	-0.056 (-1.34)
LEGROT	L E	0.80 (1.21)
OBSERVATIONS		50
CASES CORRECT		41
LOG LIKELIHOOD		-23.33
AVG LIKELIHOOD		0.63

Continuous participators in the Meadow Lake region (Table 4.7) are more likely to use less fertilizer on stubble wheat and are more likely to seed spring wheat at a later date.[80] As a group, all participators tend to spend more on herbicides for wheat on stubble (SCHEM), but there was no significant difference between continuous participators and selective participators within this group.

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[80] The statistical results indicate that the group of all participators is more likely to seed wheat later, but within this group selective participators are less likely to seed later. Therefore, we reach the conclusion that full participators are more likely to seed wheat later if they are forced to.

Table 4.7: Impact of Crop Insurance on Farm Practices - Meadow Lake Region

Dependent Variable	All Participators	Selective Participators
CONSTANT	-.47 (-0.30)	3.07 (1.51)
SFERT	-0.046 (-1.27)	----- -----
LATEWHT	0.15* (2.22)	-0.095 (-1.09)
SCHEM	0.07* (1.67)	----- -----
CVSWS	9.47* (-2.50)	-6.83 (-1.38)
LEGROT	----- -----	1.34* (1.66)
OBSERVATIONS	38	24
CASES CORRECT	26	16
LOG LIKELIHOOD	-19.54	-11.64
AVG LIKELIHOOD	0.60	0.61

Furthermore, the results indicate that the group of all participators have a lower coefficient of variation (CV) of spring wheat yields (CVSWS), but it is interesting to note that within this group it appears that the CV of selective participators tends to be lower than continuous participators.[81] Finally, within the group of all participators the results indicate that selective participators are more likely to have a legume in the rotation.

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[81] This result is not very significant, but we point out that the selective probit had only 24 observations. With more observations this result may have been more significant.

In the Melfort region, the results are somewhat similar but overall they tend to show greater significance than in the Meadow Lake region (Table 4.8). Participators in crop insurance appear to be more likely to seed more crops (CROPNUM) in the Melfort region. This result may indicate an attempt on the part of some producers to risk split their farm operations. Again, the results indicate that participators are willing to seed spring wheat later if conditions force them to. The consistency of this result across the regions tends to support the concerns raised by Soil Conservation Canada that the June 20 seeding date deadline may encourage improper agronomic practices.

Supporting the somewhat tentative results from the Meadow Lake region is the statistical inference of expected stubble spring wheat yields in both probits (YSWS). It appears that expected spring wheat yields are lower for the group of all participators when compared to non-participators.[82] However, when one compares the yields of selective participators to continuous participators, their expected yields are significantly higher[83]

The remainder of the results in Table 4.8 indicate some other interesting characteristics about the farm management practices of selective participators. First, they tend to have lower commercial fertilizer costs for spring wheat on stubble. This seems counterintuitive to their higher expected yields, but they are also much more likely to have a legume in their farm crop rotation. One could argue that the nitrogen fixing properties of the legume lowers the need for commercial fertilizers. Second, selective participators are much more likely to use forward contracting to market at least some of their production (FOR).

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[82] This result has a level of confidence of less than 30%.

[83] Note that both probits have substantially more observations than the Meadow Lake region.

Table 4.8: Impact of Crop Insurance on Farm Practices - Melfort Region

Dependent Variable	All Participators	Selective Participators
CONSTANT	5.47 (2.25)	-3.32 (-1.32)
CROPNUM	0.20 (1.25)	----- -----
LATEWHT	-0.12* (-2.52)	----- -----
YSWS	-0.05 (-0.89)	0.12* (1.89)
LEGROT	----- -----	1.26* (2.037)
SFERT	----- -----	-0.16* (-2.39)
FOR	----- -----	2.50* (2.71)
HAIL	----- -----	-.017* (-1.69)
ST	----- -----	1.10* (1.65)
OBSERVATIONS	51	41
CASES CORRECT	40	33
LOG LIKELIHOOD	-21.24	-15.78
AVG LIKELIHOOD	0.66	0.68

Therefore, they perceive hedging their production as an important marketing strategy to reduce their risk. This seems to contrast with their decision to selectively participate, but Chapter II points out that even a risk averse producer may not participate in crop insurance every year or for every crop.

Third, selective participators are less likely to have hail insurance. This seems to suggest that they will insure if they have some knowledge about the probability of an event's occurrence (e.g. drought) but do not insure against outcomes which are entirely uncertain. Finally, the results suggest that selective participators are more likely to stubble snow trap when compared with other producers. Again, this reflects a higher level of management intensity and may account for their somewhat higher yield expectations.

4.5 Conclusions

The analysis of farm structural characteristics in section 4.3 indicated that selective participators had larger farms and were more educated. At that point, it appeared that this group of producers may be better than average managers. The results of the farm practices section seem to confirm these speculations.

In all four areas, selective participators were found to have higher expected yields or lower coefficient of variation of expected yields than continuous participators.[84] In fact, in two of the four regions, selective participators were able to maintain higher expected yields with lower commercial fertilizer use. The results suggest that these producers use nitrogen fixing crops like lentils and peas to reduce commercial fertilizer use.

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[84] With the exception of the Meadow Lake region, all of these were significant with at least a 30 percent level of confidence.

In contrast, continuous participators had somewhat lower yields and were more likely to consider seeding spring wheat later.[85] In addition, continuous participators are less likely to try specialty crops like peas and lentils. Therefore, they avoid crops which require more intensive marketing skills.[86]

Overall, the results of the farm practices section suggest that adverse selection is a serious problem with the Saskatchewan All Risk Crop Insurance program. Producers with higher and less variable yields only participate in those years, or for those crops, which are likely to yield them a positive net benefit. These producers do not find it economical to participate on a continuous basis with their whole farm operation. In contrast, producers with lower expected yields and a greater probability of collecting indemnities, participate on a continuous basis. It is the classic example of adverse selection.

Rather surprisingly, a number of variables, which one might expect to be significant in explaining differences in participation, appeared unimportant. For instance, the statistical model could not distinguish any rotational differences between participators and non-participators. The percentage of summerfallow in the rotations of participators and non-participators was similar in all regions. Also interesting, is the result that participation in crop insurance did not have any appreciable affect on the number of crops grown.[87] Perhaps this is not that surprising since the conceptual model predicted that crop insurance created conflicting incentives in crop selection. The results suggest that the conflicting incentives may cancel each other out.[88]

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[85] The only exception was the Melfort region, where participators would not consider seeding spring wheat as late as non-participators.

[86] In the Melfort region, continuous participators are less likely to grow specialty crops and are therefore less likely to use marketing tools like forward contracting.

With respect to marginal land use, participators and non-participators did not differ in the number of acres that they had broken or cleared since 1972. Again, this is not surprising since there are many other reasons why marginal land was brought into grain production through the 1970s and 80s. The economics of high grain prices and government programs like the Western Grain Transportation Act (WGTA) and Western Grain Stabilization Act (WGSA) probably had more important impacts on the cultivation of marginal land through the 1970s than crop insurance. Furthermore, in the 1980s, crop insurance has again been dwarfed by the WGTA, WGSA and the Special Canadian Grains program.

However, this does not provide conclusive evidence that crop insurance has had no impact upon the cultivation of marginal land in Saskatchewan. In chapter II, we point out that any subsidy tied to a specific enterprise, in this case grain production, must have some impact on land use at the margin.

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[87] The only exception was in the Melfort region where participators tended to seed more crops then non-participators. However, even in this region, the result is not significant at a 10 percent level of confidence.

[88] In the southern regions, another important factor is the restricted number of crops which are agronomically feasible.

CHAPTER V

REGIONAL COMPARISONS OF INSURANCE VALUE

5.1 Introduction

Historically, participation rates in the Saskatchewan All Risk Crop Insurance program have been substantially lower in the black soil zone than the brown and dark brown soil zones as shown by Tables 3.1 through 3.4. Many argue that the reason for this phenomena is that crop insurance is a less valuable program in Northern areas where crop yields, on both summerfallow and stubble tend to be higher. In fact, many producers who farm on black soils argue that there is no difference in their stubble or summerfallow yields, yet the guaranteed yields offered by crop insurance tend to reflect a substantial difference. Therefore, for many of these farmers, the value of the coverage is less than the cost of attaining it (see equation (2.9)).

This chapter determines whether the above statements are valid using the empirical data from the farm survey, as well as historical yield data collected from the Saskatchewan Crop Insurance Corporation. The second section of this chapter discusses the methodology used to derive our results. In addition, it provides some theoretical support for those who maintain that higher yielding regions are less likely to collect indemnities based on the current method of calculating guaranteed yields. The third section illustrates and discusses the results for the four regions surveyed. The fourth section presents similar results for selected rural municipalities in Saskatchewan. These results are based on historical yield data to see how they compare with the results of the survey data in section three. Our conclusions follow.

5.2 Method of Analysis

The Saskatchewan All Risk Crop Insurance program provides three basic levels of coverage;[89]

(1) 60% of area average yield,

(2) 70% of area average yield, and

(3) 80% of individual yield, if the individual producer can provide the records necessary to calculate a 10 year average yield for each crop insured on his farm operation. Each of the coverage levels above has associated with it a premium rate structure which is sensitive to the area and crop insured.[90] Therefore, it should incorporate the actuarial risk of insuring a crop in a particular region.

From a theoretical standpoint, it appears that the most important factor which could cause discrepancies in the value of insurance across regions is the percentage nature of the guaranteed yields offered by crop insurance. As Skees and Reed (1986) point out, crop insurance programs that use this approach to set yield guarantees are based on the implicit assumption "that relative yield risk (coefficient of variation) is constant across farms with different expected yields" (p.654). In other words, if the standard deviation of crop yield does not increase proportionately with average expected yield as one moves from regions with lower yields to regions with higher yields, then crop insurance has to provide less protection in higher yielding regions.[91] As an hypothetical example, suppose a producer in a lower yielding region chooses 70 percent of area average coverage where the area average yield is 20 bu/acre. This producer is guaranteed a yield of 14 bu/acre. In comparison, a producer in a higher yielding region chooses the same level of coverage with an area average yield of 40 bu/acre. His/her guaranteed yield is 28 bu/acre. Therefore, the first producer must take a 6 bushel loss before collecting any indemnities while the second takes a 12 bushel loss. If both producers are paying similar premium rates, and both have similar variances of expected yield, then obviously the first producer is much more likely to collect indemnities and participate than the second. Consequently, the percentage nature of the guaranteed yields may penalize higher yielding areas if premiums are not modified to reflect the lower probability of collecting.

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[89] These were the coverage levels offered in the 1989 program.

[90] These are adjusted for different soil productivity indexes in each of the risk areas.

Interestingly, this same argument applies directly to stubble versus summerfallow yield coverage in the Saskatchewan program. Currently, the crop insurance program charges the same premium rate for a particular crop regardless of whether the crop is grown on stubble or summerfallow. Therefore, since crop insurance guarantees a percentage of the area average yield, and stubble yields are generally lower than fallow yields, the above principle maintains that insuring crops grown on stubble must be a "better deal" than insuring crops grown on fallow.[92] Therefore, Soil Conservation Canada's statement that crop insurance provides incentives to continue erosive wheat-fallow crop rotations can be rejected outright based on the above comments.[93] However, we save our final conclusion on this issue until we view the empirical results.

---

[91] Thus, a farmer who insures in higher yielding regions is less likely to collect and when he collects the indemnities on average will be lower. Therefore, where guaranteed yields are calculated as a percentage of area average yields, premiums must be substantially lower in high yielding regions to ensure farmer participation. Unfortunately, this means that producers in higher yielding regions are forced to take on more risk since crop insurance is not as valuable a tool for managing yield risk.

The data calculated and presented in this chapter are based on a methodology outlined in Skees and Reed (1986). The authors of that research were interested in showing how rate making in the United States Federal Crop insurance program could result in adverse selection. In their paper, they used the polynomial function for integration of a normally distributed density function to estimate the expected losses associated with a given yield guarantee. We show the formula they used in their analysis below:

$$Z = \left[1/\sqrt{2\pi}\right] e^{-1/2[(EY - Y_g)/SD]^2} \quad (5.1)$$

$$T = 1/[1 + b(EY - Y_g)/SD] \quad (5.2)$$

$$P = Z\ (a_1T + a_2T^2 + a_3T^3) \quad (5.3)$$

$$EL = P\ (Y_g - EY) + Z\ SD \quad (5.4)$$

---

[92] The only possible ways this statement could not be true is if the yield guarantees available for stubble and summerfallow are not based on area average yields (i.e., stubble yields guarantees are based on some value less the stated percentage of the area average yield), or if stubble yields consistently exceed summerfallow yields.

[93] This statement is based on the premise that stubble crop yields are at least as variable as crops grown on summerfallow (Weisensel, 1988). Many maintain that stubble yields tend to be more variable than fallow yields. If this is the case, then the discrepancy between fallow and stubble coverage becomes even more apparent. Therefore, insurance on stubble will always be better deal than insurance on fallow in any region where stubble yields are less than fallow yields.

where $b = 0.33267$, $a_1 = 0.4361836$, $a_2 = -0.1201676$, and $a_3 = 0.937298$ (see Skees and Reed, 1986). In addition, EY is the expected yield, Y_g is the guaranteed yield offered by crop insurance, SD is the standard deviation of yield, P is the probability of collecting in a given year and Z and T are intermediate variables necessary to calculate expected losses.

Mean yields (EY) and the standard deviation of yields (SD) were calculated from the percentile based beta (triangular) distribution collected through the farm survey (see question 3.3 in the Appendix). The formulae used to calculate this data are illustrated below (Young, 1983):[94]

$$EY = (LY + 4MY + HY)/6 \tag{5.5}$$

$$SD = (HY - LY)/3.19 \tag{5.6}$$

where LY, MY and HY refer to the lowest yield, most likely yield and the highest yield, respectively. Using the data from the survey, expected yields and variability of yields were calculated for each producer surveyed. These figures represent the distribution of yield for each crop grown on the farm and are directly comparable to the yield coverage offered by the crop insurance program.[95]

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[94] Note that this is the same method used to calculate the expected yields and the coefficient of variation of yields as in the probit analysis of chapter IV.

[95] They are comparable because they represent the distribution of production broken down to a per acre figure for the total acreage allocated to a particular crop on the farm surveyed. Therefore, they have the same interpretation as the yield guarantees offered by crop insurance. The only component of the insurance coverage that the yield distributions do not represent is the spot loss nature of hail insurance coverage.

Table 5.1 illustrates the yield distributions for the major crops grown in each of the regions. These distributions are based on the results of equations (5.5) and (5.6).[96] Overall, the yield distributions reported tend to align well with other data sources. For example the Saskatchewan Agriculture Statistics Handbook (1987) show 10 year average yields of 23.0, 27.3, 29.1, and 29.1 bushels/acre for the Chaplin-Central Butte, Moose Jaw, Meadow Lake and Melfort regions, respectively.[97] Generally, the hypothesis that stubble yields tend to be more variable than fallow yields is not supported by the results reported in Table 5.1. The only region which consistently reported that stubble yields are more variable than summerfallow is Melfort.[98] However, even in this region, there is no statistical difference between the variability of stubble and summerfallow yields.

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[96] It is important that we clarify this point. In Table 5.1, the mean and standard deviation (Std Dev) are both means in the statistical sense. The first is the group mean for the results of equation (5.5) while the second is the group mean for the results of equation (5.6). Therefore, table 5.1 gives no indication regarding the variability of these group estimates.

[97] The 10 year averages are from crop districts 3an, 2b, 9b and 8a, respectively. With the exception of the Melfort region, these crop districts correspond fairly well with the surveyed regions. However, the discrepancy between crop district 8a and the producers surveyed in the Melfort region could explain the substantial difference in yield expectations from the two sources. The farm survey was performed in close proximity to Melfort, while crop district 8a expands from Melfort to the eastern border of the province.

[98] Producers in the Melfort region are the most highly educated as illustrated in Tables 3.1-3.4. Therefore, it is possible that they had a better understanding of the percentile based beta distribution questions (see Appendix).

Table 5.1: Distribution of Yields for Major Crops by Region

(bushels/acre)

	Spring Wheat		Durum Wheat		Barley		Canola	
	Fallow	Stubble	Fallow	Stubble	Fallow	Stubble	Fallow	Stubble
CHAPLIN-CENTRAL BUTTE								
Mean	23.1	17.0	22.5	NA	38.9	24.5	NA	NA
Std Dev	7.7	5.6	7.4	NA	12.0	9.0	NA	NA
Observ	50	7	28	NA	8	5	NA	NA
MOOSEJAW								
Mean	31.5	24.5	32.3	NA	52.6	44.2	NA	NA
Std Dev	8.4	8.4	8.2	NA	14.9	13.4	NA	NA
Observ	54	33	53	NA	24	17	NA	NA
MEADOW LAKE								
Mean	31.4	30.6	NA	NA	58.2	56.9	29.0	25.6
Std Dev	8.0	6.5	NA	NA	13.5	11.8	7.0	5.9
Observ	27	38	NA	NA	13	35	32	31
MELFORT								
Mean	40.8	34.1	NA	NA	67.8	60.8	32.1	26.8
Std Dev	8.3	9.8	NA	NA	15.7	17.7	6.7	7.7
Observ	12	51	NA	NA	6	53	26	43

Source: Farm Survey.

5.3 The Benefits of Participation: A Regional Comparison

The purpose of this section of the chapter is to compare and contrast the expected value of participating in crop insurance in the four regions based on the individual farm yield distributions used to calculate Table 5.1.[99] The benefits of participating in crop insurance are broken down into two basic components; (1) drought loss and (2) spot hail loss. The drought loss component was calculated using equations (5.1) through (5.4) and therefore represents the expected loss associated with crop production across the entire farm. In contrast, the spot hail loss component must be treated separately from the whole farm analysis, since it is adjusted on a field by field basis.[100] Therefore, we used 1989 hail rates as determined by the Cooperative Hail Insurance Company Ltd. to calculate the expected value of hail coverage for each of the regions. It was assumed that the Cooperative Hail Insurance Company would provide the most reasonable rates because of their policy to provide insurance at cost.[101] The hail rates are calculated for each township in the province. Consequently, the rate used for each of the regions represents an average for the townships within that region. Crop Insurance premiums in each region were based on the average soil productivity index for that region. Finally, a net benefit of insurance figure is calculated as the expected indemnity of insurance, which includes both the drought and hail loss components, less the premium cost. The results of this analysis are presented in Tables 5.2 through 5.5. The units used in these tables are bushels per acre. Therefore, they are independent of the prices offered by the market ~~or~~ crop insurance. Dollar values of the coverage could be calculated by using the price option offered by crop insurance.

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[99] In this chapter, we assume that all farmers choose the 70% of area average yield coverage. In addition, we assume that each producer has no experience discount on premiums or changes in coverage adjustment. Therefore, the analysis will give the expected value of insurance by region as if all farmers were starting the program for the first time.

For spring wheat, the net benefit of crop insurance is the highest for the Chaplin-Central Butte region since it has positive benefits on both stubble and summerfallow for the average producer. Therefore, in the Chaplin-Central Butte region well over half the producers perceive a positive net benefit to participating continuously in the program. This contrasts to the Moose Jaw region where only participators who seed stubble wheat perceive a net benefit from crop insurance.[102] Surprisingly, in the Meadow Lake region, summerfallow coverage has a positive net benefit, while stubble coverage has a negative net benefit. However, if one examines Table 5.1 closely this result is easily explained, since the group reported greater variability in summerfallow yields as compared to stubble. Finally, the average risk neutral producer in the Melfort region will not participate in crop insurance since the net benefit is negative for both fallow and stubble wheat.

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[100] Losses due to hail are not averaged across fields. In fact crop insurance will adjust parts of fields for spot loss hail. Therefore, even a 160 acre field will not be averaged if half of it has received hail damage.

[101] The nature of a cooperative company is to supply services at cost to its members. Finally, since the cooperative returned an average dividend of 20% over the last 5 years all hail rates were adjusted to reflect this as an actuarial rate.

In all four areas, the majority of producers are better off without barley coverage unless they are risk averse. It is interesting to note that the results support our earlier statement that stubble coverage is a better deal than summerfallow coverage due to the rate structure of the crop insurance program. However, with the exception of the Chaplin-Central Butte region, the average producer still perceives a net loss from participating with stubble barley.

In the Melfort and Meadow Lake regions, canola coverage appears to be a marginal investment for the average producer in these areas. However, if producers are risk averse, one could argue that many producers would insure canola where they certainly would not insure wheat. This tends to support the general findings of the survey, since many producers in the two northern regions insured their canola crops, but did not insure wheat or barley.

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[102] The results are similar for durum wheat, although we only report results for durum seeded on fallow.

Table 5.2: The Value of Insurance for Selected Crops: Chaplin-Central Butte

CROPS
(bushels/acre)

Spring Wheat

	Fallow				Stubble			
	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost
Mean	1.210	1.747	1.258	0.489	0.746	1.122	0.8806	0.241
Std. Dev.	1.101	1.101	NA	1.101	0.524	0.524	NA	0.524
Minimum	0.088	0.625	NA	-0.633	0.110	0.486	NA	-0.395
Maximum	4.519	5.056	NA	3.798	1.586	1.962	NA	1.082
Observ.	50	50	NA	50	7	7	NA	7

Barley

	Fallow				Stubble			
	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost
Mean	1.215	2.015	2.960	-0.945	1.475	1.990	1.907	0.083
Std. Dev.	0.942	0.942	NA	0.942	1.431	1.431	NA	1.431
Minimum	0.001	0.801	NA	-2.160	0.001	0.516	NA	-1.391
Maximum	2.745	3.545	NA	0.585	3.904	4.419	NA	2.512
Observ.	8	8	NA	8	5	5	NA	5

Durum

	Fallow			
	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost
Mean	1.182	1.706	1.394	0.312
Std. Dev.	1.111	1.111	NA	1.111
Minimum	0.075	0.599	NA	-0.795
Maximum	4.259	4.783	NA	3.389
Observ.	28	28	NA	28

Table 5.3: The Value of Insurance for Selected Crops: Moose Jaw Region

CROPS
(bushels/acre)

Spring Wheat

	Fallow				Stubble			
	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost
Mean	0.538	1.027	1.183	-0.156	0.844	1.206	0.876	0.330
Std. Dev.	0.450	0.450	NA	0.450	0.801	0.801	NA	0.801
Minimum	0.000	0.490	NA	-0.694	0.000	0.362	NA	-0.513
Maximum	1.719	2.209	NA	1.026	3.220	3.582	NA	2.706
Observ.	54	54	NA	54	33	33	NA	33

Barley

	Fallow				Stubble			
	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost
Mean	1.037	1.800	2.862	-1.062	0.955	1.497	2.034	-0.537
Std. Dev.	1.091	1.091	NA	1.091	0.963	0.963	NA	0.963
Minimum	0.001	0.764	NA	-2.098	-0.000	0.542	NA	-1.492
Maximum	4.691	5.454	NA	2.592	3.460	4.003	NA	1.969
Observ.	24	24	NA	24	17	17	NA	17

Durum

	Fallow			
	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost
Mean	0.622	1.136	1.241	-0.106
Std. Dev.	0.694	0.694	NA	0.694
Minimum	0.000	0.514	NA	-0.728
Maximum	3.264	3.777	NA	2.536
Observ.	53	53	NA	53

Table 5.4: The Value of Insurance for Selected Crops: Meadow Lake Region

CROPS
(bushels/acre)

Spring Wheat

	Fallow				Stubble			
	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost
Mean	1.344	1.941	1.150	0.791	0.281	0.774	0.950	-0.176
Std. Dev.	3.154	3.154	NA	3.154	0.510	0.510	NA	0.510
Minimum	0.000	0.596	NA	-0.554	0.000	0.493	NA	-0.458
Maximum	16.668	17.265	NA	16.115	2.064	2.557	NA	1.606
Observ.	26	26	NA	26	37	37	NA	37

Barley

	Fallow				Stubble			
	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost
Mean	0.382	1.247	1.885	-0.638	0.257	0.985	1.586	-0.601
Std. Dev.	0.472	0.472	NA	0.472	0.492	0.492	NA	0.492
Minimum	0.000	0.865	NA	-1.020	-0.000	0.728	NA	-0.858
Maximum	1.522	2.387	NA	0.502	1.816	2.544	NA	0.958
Observ.	13	13	NA	13	34	34	NA	34

Canola

	Fallow				Stubble			
	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost
Mean	0.325	1.193	1.147	0.046	0.087	0.736	0.8584	-0.122
Std. Dev.	0.616	0.616	NA	0.616	0.128	0.128	NA	0.128
Minimum	0.000	0.868	NA	-0.279	0.000	0.650	NA	-0.209
Maximum	2.504	3.372	NA	2.225	0.499	1.149	NA	0.290
Observ.	31	31	NA	31	31	31	NA	31

Table 5.5: The Value of Insurance for Selected Crops: Melfort Region

CROPS
(bushels/acre)

	Fallow				Stubble			
Spring Wheat								
	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost
Mean	0.167	0.650	1.299	-0.650	0.620	1.042	1.137	-0.095
Std. Dev.	0.376	0.376	NA	0.376	0.689	0.689	NA	0.689
Minimum	0.001	0.484	NA	-0.815	0.000	0.422	NA	-0.715
Maximum	1.394	1.877	NA	0.577	2.450	2.873	NA	1.736
Observ.	12	12	NA	12	51	51	NA	51
Barley								
	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost
Mean	0.602	1.313	1.813	-0.499	0.726	1.375	1.654	-0.279
Std. Dev.	0.751	0.751	NA	0.751	0.807	0.807	NA	0.807
Minimum	0.000	0.711	NA	-1.101	-0.000	0.649	NA	-1.005
Maximum	2.054	2.765	NA	0.952	3.397	4.046	NA	2.393
Observ.	6	6	NA	6	53	53	NA	53
Canola								
	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost	Drought Loss	Hail + Drought	Premium	Net Benefit or Cost
Mean	0.240	0.956	1.204	-0.248	0.342	0.920	0.973	-0.053
Std. Dev.	0.474	0.474	NA	0.474	0.410	0.410	NA	0.410
Minimum	-0.000	0.716	NA	-0.488	0.000	0.578	NA	-0.395
Maximum	1.871	2.586	NA	1.382	1.515	2.093	NA	1.120
Observ.	26	26	NA	26	43	43	NA	43

Unfortunately, the results in Tables 5.2 through 5.5 do not indicate whether the value of insurance is significantly different across the regions. To test whether there are differences, we use a linear regression model which has as its dependent variable (Y_1) the net benefit of insurance by region.[103] The independent variables are dummy variables which delineate whether the Y_i is associated with a particular region. The dummy variable takes a value of 1 if it is associated with that particular region and 0 otherwise.[104] The results of the regression model are presented below:[105]

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[103] We examine spring wheat, since it is the main crop grown consistently across all four regions. The analysis includes all observations on the net benefit of spring wheat seeded on fallow and stubble.

$$Y = \underset{(2.78)}{0.459} + \underset{(-2.03)}{-0.430}\, X_1 + \underset{(-1.04)}{-0.236}\, X_2 + \underset{(-2.90)}{-0.659}\, X_3 + e \qquad (5.7)$$

Usable Observations = 270 Significance of F-statistic = 0.9997

In the regression equation, X_1, X_2 and X_3 are the dummy variables associated with the Moose Jaw, Meadow Lake and Melfort regions, respectively. The coefficient for the Chaplin-Central Butte region is incorporated in the intercept term. The significance level of the F-statistic as well as two of the t-statistics indicate that there are substantial differences in the value of crop insurance across different regions in Saskatchewan. Both the Melfort and Moose Jaw regions have significantly less coverage from the crop insurance program when compared to the Chaplin-Central Butte region.[106] However, there is no significant difference in the average net benefit of the Meadow Lake region when compared to the Chaplin-Central Butte region. As an additional check of differences in the benefit of insurance across regions, we tested if there were significant differences in the coverage at Moose Jaw and Melfort when compared to Meadow Lake. We used a t-test to determine whether there are significant differences in the coefficients estimated in equation (5.7).[107] Based on a 90% level of confidence, there is a significant difference between the Melfort and Meadow Lake regions ($t = -1.91$). However, no other comparisons yielded significant results.

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[104] A regression model of this type is analogous to one-way analysis of variance where the treatments are the different regions. Therefore, the F-statistic will determine whether there are significant differences between regions. The advantage of the regression method is that the t-statistics will determine which regions are significantly different.

[105] T-statistics are presented below each of the coefficients in brackets.

[106] The average net benefit of insurance in the Chaplin-Central Butte region is 0.459 bu/acre. This reduces to 0.029 and -0.200 bu/acre in the Moose Jaw and Melfort regions, respectively. These results are significant at a 95% level of confidence.

Overall, the statistics reported in this section definitely support the hypothesis that there are significant differences in the value of crop insurance across the four regions. Generally, it appears that higher yielding regions receive less benefits from the crop insurance program. Therefore, from a land use perspective, crop insurance has little effect on major enterprise decisions (i.e., pasture versus grain production) in these regions. However, in areas which have lower and wider variability in land quality (i.e., Chaplin-Central Butte and Meadow Lake) crop insurance has a more significant impact on the margin. This is an important result, since it is in these more marginal regions where a net benefit from crop insurance is likely to have an impact on major land use decisions.

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[107] The t-test used is shown below:

$$T = \frac{(B_i - B_j) - 0}{s\,(a_{ii} + a_{jj} + 2a_{ij})^{0.5}}$$

where s, a_{ii}, a_{jj} and a_{ij} are the estimated standard error of the regression and the respective coefficients from the variance-covariance matrix of B.

The results of this section have shown the regional value of crop insurance based on the yield expectations of producers. Some may argue that producers responding to the yield questions have a strategic bias to overestimate their yields, particularly if they believe that their responses may have an impact upon future coverage levels from crop insurance. We point out that members of the survey team emphasized the independent nature of this study. Finally, they highlighted the fact that no results would be reported that were not in area average form. However, to alleviate any concerns individuals may have, the following section performs a similar analysis based on 15 years of average yields from selected rural municipalities. Many of the rural municipalities correspond to the surveyed regions, however others were selected outside the survey regions to expand the analysis.

5.4 The Benefits of Participation: An Historical Analysis

To confirm and expand the results of the previous section, this section uses historical record of production data collected by the Crop Insurance Corporation to calculate the value of crop insurance for spring wheat in various rural municipalities. Mean yields and standard deviation of yields were calculated based on 15 years of average yields collected from each rural municipality.[108] Therefore, the expected loss figures illustrated in Table 5.6 represent a single point estimate as determined from the historical distribution of yields. Similar to the last section of the chapter, spot loss hail rates determined from the Cooperative Hail Insurance Co. are used to calculate the expected hail losses. Finally, the premium rates and yield guarantees illustrated in Table 5.6 are based on the average soil productivity index for each rural municipality.

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[108] The yields in each of the municipalities were checked for trends that might occur due to technological advance. All tests rejected the hypothesis that yields increased over time due to a technology factor.

When one compares the historical yield distributions from Table 5.6 to the distributions elicited from producers, they tend to correspond reasonably well.[109] It is interesting to note that the correspondence is much closer in the two southern regions when compared to the two northern regions. However, one could hypothesize a simple explanation. Since a larger percentage of the producers in the two southern regions participate in crop insurance (see Tables 3.1 through 3.4), it is likely that the sample of farmers in Tables 5.1 and 5.6 are similar. However, lower participation rates in the northern regions, means that the sample of producers in the two tables are likely to be substantially different. Table 5.6 is based on the group of producers who participate in crop insurance, where adverse selection has already been shown to be a problem (see chapter IV). Therefore, the expected yields in the northern rural municipalities are bound to be lower in Table 5.6 when compared to Table 5.1.

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[109] Figure 3.1 illustrates the location of each rural municipality (RM) in the province. Chaplin-Central Butte corresponds to RMs 164, 193, 194 and 224. Moqse Jaw corresponds to 160, 161, and 191. The Melfort region encompasses RMs 428, 429, and 457. Finally, the Meadow lake region is made up of the RMs 561, 588, and 622. However, very few observations were collected from RM 622.

Table 5.6: The Value of Insurance for Selected Rural Municipalities: 15 Year Historical Spring Wheat Yields

	164		168		169		193		194	
	FALLOW	STUBBLE	FALLOW	STUBBLE	FALLOW	STUBBLE	FALLOW	STUBBLE	FALLOW	STUBBLE
					(bushels/acre)					
Mean	21.44	12.38	23.63	13.50	25.50	13.44	23.88	14.87	23.63	14.50
Std Dev	7.01	6.14	6.72	4.62	7.49	10.22	7.82	6.32	7.03	6.03
Yguarantee	17	11.9	17.6	11.4	17.6	11.4	17	11.9	17	11.9
Premium	1.258	0.881	1.144	0.741	1.144	0.741	1.258	0.881	1.258	0.881
Expected Loss	1.120	2.220	0.678	0.981	0.562	3.140	0.815	1.312	0.654	1.326
Hail Loss	0.571	0.400	0.803	0.520	0.563	0.365	0.585	0.409	0.612	0.428
Net Benefit	0.433	1.740	0.337	0.760	-0.019	2.764	0.142	0.841	0.008	0.874

	224		160		161		191		345	
	FALLOW	STUBBLE	FALLOW	STUBBLE	FALLOW	STUBBLE	FALLOW	STUBBLE	FALLOW	STUBBLE
Mean	20.25	12.31	30.63	22.88	30.19	22.44	27.31	20.63	27.44	21.19
Std Dev	8.02	6.83	7.92	8.20	7.83	8.27	7.85	6.91	7.62	7.88
Yguarantee	16.8	11.7	19.5	14.2	19.5	14.2	19.5	14.2	21.6	16.8
Premium	1.176	0.608	1.151	0.838	1.151	0.838	1.151	0.838	1.123	0.991
Expected Loss	1.766	2.431	0.288	0.611	0.310	0.694	0.660	0.657	0.973	1.426
Hail Loss	0.376	0.262	0.390	0.284	0.343	0.250	0.671	0.488	0.778	0.605
Net Benefit	0.966	2.085	-0.473	0.057	-0.498	0.106	0.180	0.307	0.628	1.040

	346		347		371		401		428	
	FALLOW	STUBBLE	FALLOW	STUBBLE	FALLOW	STUBBLE	FALLOW	STUBBLE	FALLOW	STUBBLE
Mean	29.38	19.81	28.44	19.31	30.13	22.31	33.56	25.31	31.56	30.31
Std Dev	7.50	7.53	5.73	6.48	7.33	7.17	6.43	7.17	5.60	8.01
Yguarantee	20.3	14.2	20.3	14.2	20.2	15.2	22.4	17.4	23.2	20.3
Premium	0.995	0.696	0.995	0.696	0.990	0.745	1.053	0.818	1.299	1.137
Expected Loss	0.412	0.995	0.202	0.794	0.297	0.608	0.108	0.488	0.167	0.406
Hail Loss	0.520	0.364	0.763	0.534	0.824	0.620	0.573	0.445	0.427	0.374
Net Benefit	-0.063	0.662	-0.030	0.632	0.132	0.483	-0.372	0.115	-0.706	-0.357

	429		457		561		588		622	
	FALLOW	STUBBLE	FALLOW	STUBBLE	FALLOW	STUBBLE	FALLOW	STUBBLE	FALLOW	STUBBLE
Mean	34.88	31.81	30.00	26.38	28.00	23.50	26.69	24.44	23.81	19.75
Std Dev	7.03	8.34	7.26	7.61	6.94	6.00	5.00	6.66	6.11	5.06
Yguarantee	23.2	20.3	23.2	20.3	21.3	17.6	21.3	17.6	21.3	17.6
Premium	1.299	1.137	1.299	1.137	1.150	0.950	1.150	0.950	1.150	0.950
Expected Loss	0.141	0.319	0.682	0.917	0.617	0.516	0.358	0.528	1.383	1.122
Hail Loss	0.464	0.406	0.557	0.487	0.596	0.493	0.596	0.493	0.767	0.634
Net Benefit	-0.694	-0.412	-0.060	0.267	0.063	0.058	-0.196	0.070	0.999	0.805

Source: Historical Record of Production Yields, Saskatchewan Crop Insurance Corporation

The results of Table 5.6 also support the earlier section with regards to the net benefit of insurance. The RMs around and west of Chaplin tend to have higher net benefits from insurance. In contrast, the Moose Jaw area tends to get positive benefits for wheat seeded on stubble but negative benefits for wheat on summerfallow. With the exception of RM 622, investment in crop insurance for spring wheat in the Meadow Lake region appears to be marginal at best.[110] Finally, based on 15 year average yields, crop insurance is not a profitable investment in the Melfort region. The only exception is wheat on stubble in RM 457.

Generally speaking, the results of Table 5.6 tend to support comments that crop insurance is more beneficial in RMs in the brown and dark brown soil zones when compared to RMs in the black soil zone. In addition, they confirm the theoretical comment made in section that insurance coverage on stubble yields must always be a better deal than insurance coverage on summerfallow yields for areas where stubble yields are lower than summerfallow yields. The only exception to this statement occurs in the Meadow Lake region.[111] However, in the Meadow Lake region producers who seeded summerfallow wheat on a regular basis tended to be lower level managers. The better managers in the area used rotations of canola followed by wheat or barley on stubble. In this area, summerfallow was avoided as much as possible since it resulted in severe soil packing.

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[110] It is important to note that in the Meadow Lake region frost and therefore, low grain quality can be important components in the decision to participate. The results in this chapter do not address this issue since we deal exclusively with yields and not price changes due to quality differences. Since crop insurance does insure for crop quality, the estimates for the Meadow Lake region may slightly underestimate the net benefits of insurance.

[111] It is interesting that the same result occurs in both Table 5.6 and Table 5.4.

5.5 Conclusions

Crop insurance is a subsidized program where the government provides a dollar for dollar contribution with the participator. Therefore, theoretically one would expect that all producers would receive a net benefit from insurance that is just equal to the premium they pay. Consequently, crop insurance would be a subsidy to grain production in all areas of the province and would affect all land at the economic margin of grain production. However, like all programs designed for groups of heterogeneous economic agents, the results of this chapter highlight the practical problems and significant income redistributions of crop insurance in the province of Saskatchewan.[112] Below is a systematic accounting of some of these problems.

First, the results give substantial support to the statement that crop insurance is a more beneficial program in the less productive regions of the province. This is an important point, since it is in these less productive regions where changes in land use are more likely to occur. It is in these regions where a majority of the marginal land exists. Consequently, even though we cannot provide a statistical link between land use and crop insurance (see chapter IV), we can show that the economic incentive exists in those regions where changes in land use are more likely to occur.

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[112] Most of the inequities are due to adverse selection and possibly moral hazard. Based on the results of this chapter, it appears that these practical problems tend to skew the distribution of indemnities such that even average producers do not find the program profitable in many areas.

Second, the results also support the statement that stubble crops are a "better insurance deal" than summerfallow crops due to the nature of crop insurance premium determination. This chapter provides both theoretical and empirical evidence which supports this statement.

Third, with the exception of the Moose Jaw region, the results of this chapter tend to explain regional differences in participation rates in crop insurance fairly well. Areas with higher insurance benefits tend to have higher participation rates. As an explanation of the high participation rates in Moose Jaw, three possible reasons exist. (1) Stubble cropping spring wheat is a frequent practice in this region and has a positive insurance value for the group. (2) Many farmers in this area have built up substantial premium discounts and coverage adjustments. Therefore, they have higher insurance value than a beginning producer would have. (3) Producers in this area could be more risk averse than in other areas.

Finally, the results in this section which represent the long run net benefits of crop insurance for average production years tend to support the actions of the selective participators. In all the regions examined, a substantial percentage of the distribution of farm operators do not perceive a net benefit from crop insurance in an average year for all crops. Therefore, they may find it more profitable to selectively participate even though they are giving up the possibility of building up coverage adjustments and premium discounts by not participating regularly. Obviously, the time value of money becomes an important component in this argument since it takes approximately 5 years to build up the maximum coverage adjustments and premium discounts.

CHAPTER VI

CONCLUSIONS AND FUTURE DIRECTIONS

6.1 Introduction

The Saskatchewan All Risk Crop Insurance program is an important stabilization policy for grain producers. Its importance is indicated by the fact that over 75 percent of the farmers in the province currently participate in the program. However, there has been a growing concern in recent years that farm land use has been detrimental to the preservation of Saskatchewan soils and crop insurance is at the center of this concern. In addition, there has also been concern regarding the discrepancy in participation rates between different production regions in the province. Therefore, the purpose of this report was to; (1) examine the causal relationships between crop insurance and farm management decisions, since it is these decisions which ultimately affect land use and (2) examine and explain differences in participation in various regions of the province.

The purpose of this chapter is to summarize the research presented in the first five chapters. In addition, based on this summary, we make a number of conclusions and discuss future directions which we feel will improve the operation of the program.

6.2 Summary and Conclusions

The first major conclusion of this study deals with the categorization of participants. In the past, it has generally been recognized that there are two groups namely; i) participators, and ii) non-participators. This study also documents and highlights a third group which we call selective participators. Selective participators are those individuals who participate only when they see a potential benefit to participating.[113] Often the factor that influences/determines this decision is spring moisture conditions. Therefore, selective participators are one component of the adverse selection problem in the current program since they only participate when they are likely to collect substantial indemnities.[114]

In addition, selective participators tend to be higher level managers than both non-participators and continuous participators. This conclusion is based on statistical evidence that selective participators tend to be more highly educated, have higher and less variable crop yields and are more likely to employ specialty crops like peas and lentils in their farm crop rotations. Just the fact that they make this decision on an annual basis says something about their intensity of management.

Surprisingly, factors such as debt load and the extent to which livestock is integrated into farm enterprises do not appear to be major factors in the decision to participate in crop insurance. Also off-farm income generally had the opposite effect than expected.

The second major conclusion of this study is that moral hazard exists in the participating group. In other words, farmers who participate in the crop insurance program tend to manage their farms somewhat differently than if the program did not exist. In chapter III, we found that a number of participators perceived that the program affected the fields they allocated to different crops as well as the number of crops they seeded.[115] In both of these cases, the producers admitted that risk splitting was the major reason for the change in behaviour. Another example of moral hazard is the latest date a farmer would consider seeding spring wheat. Farmers who participate indicated they would seed wheat later in the spring than those not in the program. Therefore the June 20th deadline for seeding encouraged farmers to seed later since they knew they were covered for the possibility of an early fall frost. In addition, there is evidence to support the classic moral hazard problem that participators tend to use less inputs than non-participators.

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[113] They may participate in selective years, for selective crops or for selected crops in selective years.

[114] Continuous participators actually subsidize the selective group since they pay premiums all the time (whether or not they are likely to collect indemnities), while the selective group pays premiums in selective years. If this was not true, the program could not be actuarial sound based on a 1:1 premium contribution by the producer and government.

The third major conclusion of the study addresses the regional benefits from crop insurance program.[116] Based on the four regions surveyed as part of the project, Melfort and MooseJaw have significantly less insurance value than does the Chaplin Central Butte region. In addition, the results show that the Melfort region has significantly less insurance value than the Meadow Lake region. Finally, an expansion of the analysis to other areas of the province indicates that the value of the crop insurance program decreases as one moves from the south western grain producing areas to north eastern grain producing areas. For instance, based on the statistical results reported and the high price option offered by crop insurance, the average producer in the Melfort region incurs a net expected loss of $0.85/acre while the average producer in the Chaplin-Central Butte region incurs a net benefit (ex-ante subsidy) of $1.94/acre.[117] Therefore, in an average year over 50 percent of the producers in the Melfort region would have to be risk averse to participate in the crop insurance program (some would have to be extremely risk averse). Obviously, this is an important factor in explaining differences in participation rates between the Chaplin-Central Butte and Melfort regions.

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[115] It is interesting that this result was more prevalent in the two southern areas then the two northern areas. Intuitively, one would expect this since (1) farms in the south tend to be larger and more spread out and (2) the value of insurance tends to be larger in the southern areas.

[116] The comparison is limited to spring wheat since it is the only crop grown consistently in each of the four regions.

As a risk management tool, crop insurance appears to have conflicting affects regarding the adoption of new technology. Some producers pointed out that lack of/lower coverage for new crop varieties (specialty crops, etc.) tended to reduce the likelihood that they seed these crops, at least in more than an experimental manner. However, contrasting this is the statement by many producers that crop insurance increases the likelihood that they will adopt new farm practices and production techniques.

The final conclusion deals with the effect of crop insurance on land use in Saskatchewan. Based on the empirical analysis comparing participators and non-participators, we were unable to find any statistical relationship between crop insurance and land use.[118] For the regions surveyed there appears to be no difference in the proportion of summerfallow among participators and non-participators.[119] However, this does not mean that the program has no impact on stubble cropping practices in all areas of the province. The empirical analysis of Chapter V showed that stubble wheat coverage was a "better insurance deal" than summerfallow wheat coverage. Therefore, it is possible that in regions where the decision to stubble crop is marginal (close using the break-even yield approach), that the benefits of crop insurance for stubble cropping may tip the scale in favour of more intensive cropping.

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[117] These results are based on 70% of area average yield coverage and average expected yields.

[118] This statement includes both the cultivation of marginal land, and the level of summerfallow acreage on cropped land.

With respect to marginal land use, there was no statistical evidence that crop insurance had any affect. However, again, we cannot conclude that crop insurance has not resulted in the cultivation of marginal land since it would be difficult to find such a relationship in a one shot survey. Even in an historical analysis, it would be perplexing, since it would be difficult, if not impossible, to separate out the effects of the myriad of government programs on marginal land use. Nonetheless, based on the theory of land rent, we have shown that crop insurance does result in substantial ex-ante subsidies for a substantial number of producers in each of the four areas. However, we also show that these ex-ante subsidies tend to be greatest in those areas where there tends to be the greatest amount of marginal land. Therefore, rational expectations suggest that crop insurance would affect land use where the margin of profitability between pasture and grain land is close.

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[119] This result was somewhat surprising since some producers felt that crop insurance did reduce the acreage they allocated to summerfallow within their rotation.

6.3 Future Directions

1. The premium rate structures for stubble and fallow crop production should be adjusted to reflect the difference in risk associated with each. Currently, premiums are set based on a particular crop and do not distinguish between whether the crop is grown on stubble or summerfallow. This policy implicitly assumes that stubble yields are less variable than summerfallow yields in all regions where area average stubble yields are less than area average summerfallow yields. Obviously, this assumption is not true.

2. Premium rates and levels of coverage should be reexamined so that regional biases in the crop insurance program are eliminated. The percentage nature of the guaranteed yield is at the heart of this problem, since higher yielding regions must accept a higher absolute loss before they collect indemnities when compared with producers in lower yielding regions. This is supported by the comments of many of the farmers in the two northern regions who state that they would be willing to pay higher premiums for more effective coverage. Currently, crop insurance reduces the variability of grain farm income much more effectively in lower yielding regions when compared to higher yielding regions.

3. Individual coverage based on individual yields is necessary to reduce the problems with adverse selection and moral hazard. Currently, even the average producer in a district does not receive a net benefit equal

to their premium cost.[120] Therefore, the area average nature of the program results in the distribution of indemnities being skewed to a relatively small group of producers. Obviously, this recommendation is not new in the sense that the long run objectives of the Saskatchewan Crop Insurance Corporation is to incorporate this as policy. However, we feel it is important to repeat it as a recommendation with some qualifications. We feel that the program should insure entire farm units.[121]

4. Our future direction is that crop insurance insure farm units based on the value of all crops produced. Individual crop coverage (i.e., treating wheat separate from barley) tends to accentuate the problem of moral hazard. We believe the purpose of crop insurance is to insure *the farm unit* against the losses associated with major crop failure. Its purpose is not to insure fifty acres of barley on a marginal piece of land, excluding the remainder of the farm operation. Producers who use crop insurance in the manner described above are in the minority, but the more often that these practices occur, the less equitable a barley contract is for the average producer in a region. The moral hazard of risk splitting barley on small marginal land tracts could be

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[120] Theoretically, if all producers were identical, each producer could expect a net benefit (expected indemnity less premium cost) from the program just equal to the premium cost, since the program is subsidized dollar for dollar.

[121] Some farm units may be divided due to partnerships, joint ventures or other arrangements, thereby risk splitting their farm operations using two or more contracts. We are not concerned with risk splitting of this type providing that there are a consistent set of policies which determine when and how this may be done.

one explanation for its negative net benefit (see Chapter V) in all regions examined. In any case, insuring the value of all crops produced on an individual farm should result in greater program equity with lower administrative costs.[122]

5. Added discounts could be given for insurance contracts negotiated and signed on a longer term basis or for those completed well before spring seeding. Changes in the nature of the contract would reduce the ability of the producer to predict his indemnity in any particular year. Consequently, selective participation would become more of a gamble since the insuree would have the same information set as the insurer.

6. The cut off date for seeding crops should be sensitive to the time it takes for a particular crop to mature. This would reduce the incentive to seed crops later than what the agronomics with out an insurance program would suggest. Generally, the cut-off dates for seeding under the current program should be set earlier.

7. All payouts to producers should be public information.

8. Additional analysis should be done from a farm management standpoint to determine the costs and benefits for a producer who continuously practices moral hazard.

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[122] Since there is less incentive to farm differently under the structure described above, less resources are needed to police the program.

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APPENDIX A.1

FARM SURVEY

PRODUCER SURVEY

Name (optional) ______________________________

Address ______________________________

____

____

Legal Land Descriptions:

____________________ ____________________

____________________ ____________________

____________________ ____________________

____________________ ____________________

____________________ ____________________

____________________ ____________________

____________________ ____________________

____________________ ____________________

____________________ ____________________

____________________ ____________________

RM No ____________________ **(Home Quarter)**

1. Farming Operations

1.1 (E) Are you the sole operator or a partner?

____

1.1.1 (E) Is the farm incorporated?

____

1.2 (E) How many years (total) have you been farming as an operator?

________ **years**

1.3 (E) How many acres is your farm, both owned and leased?

	Owned	Leased
Total Acres:	_____ acres	______ acres
Cultivated Acres:	_____ acres	______ acres
Non-cultivated:		
Pasture and Hayland	_____ acres	______ acres
Slough and Waste	_____ acres	______ acres

1.4 (E) How many acres of land did you seed in each of the following categories in 1987, 1988 and 1989?

	1987	1988	1989
spring wheat	_______ acres	_______ acres	______ acres
durum	_______ acres	_______ acres	______ acres
oats	_______ acres	_______ acres	______ acres
barley	_______ acres	_______ acres	______ acres
rye	_______ acres	_______ acres	______ acres
flax	_______ acres	_______ acres	______ acres
canola	_______ acres	_______ acres	______ acres
peas	_______ acres	_______ acres	______ acres
lentils	_______ acres	_______ acres	______ acres
hay	_______ acres	_______ acres	______ acres
alfalfa	_______ acres	_______ acres	______ acres
other crops (identify)	_______ acres	_______ acres	______ acres
	_______ acres	_______ acres	______ acres
summerfallow	_______ acres	_______ acres	______ acres

1.5 (E) Approximately what percent of your gross farm income is derived from livestock operations?

_______ %

1.5.1 (E) How many dairy cows do you have (if any)? ________

1.5.2 (E) How many beef cattle do you have (if any)? ________
(identify type)

1.5.3 (E) How many hogs do you have (if any)? ________

1.6 (E) Personal Data:

1.6.1 (E) What is the highest grade you completed at school? ________
grade

1.6.2 (E) How many years of post secondary education or trade did you complete? (Include University, trade or technical school, vocational agriculture training, etc.)

____
years

1.6.3 (E) What is your age? ________
years

1.6.4 (E) How many dependents do you support? ________

1.6.5 (E) Do you have off-farm employment? (a) yes (b) no

1.6.6 (E) Does your spouse work off the farm? (a) yes (b) no

1.7 (E) Financial:

1.7.1 (E) Given this is a period of uncertainty and trouble in the farm community, could you provide us with an approximate estimate of your ratio of total debt to total assets?

Debt/Assets ________

2. General Information on Crop Insurance

2.1 (E) Have you ever purchased crop insurance on your farm operation? (Circle)

(a) yes (b) no

IF ANSWER TO ABOVE WAS YES, THEN ASK THE REMAINING QUESTIONS FOR 2.1, OTHERWISE GO TO QUESTION 2.2. (PAGE 7).

2.1.1 (PS) Have you purchased crop insurance this year? (Circle)

(a) yes (b) no

2.1.2 (PS) How many years (total) have you purchased crop insurance on your farm?

__________years

2.1.3 (PS) How important are each of the following statements in your decision to participate in crop insurance? Indicate the importance of each of the following factors where 1-unimportant, 2-somewhat important, 3-important, 4-very important.

____ reduce risk
____ hail insurance
____ drought insurance
____ concentrated landbase
____ pests (insects, wildlife, etc.)
____ lending institution
____ debt levels
____ frost
____ other (specify) ________________

2.1.4 (PS) Do you purchase crop insurance every year on all your acres without hesitation, or do you purchase it in selective years for selective acres depending on your situation?

(a) every year (b) selective years or acres

IF THE RESPONSE TO 2.1.4 IS (B), THEN ANSWER 2.1.4.1 AND 2.1.4.2, OTHERWISE GO TO QUESTION 2.1.5.

2.1.4.1 (S) If you purchase crop insurance on a selective basis could you give an account of which years out of the last 10 you participated in crop insurance. In addition, indicate the percentage of your cropped acreage which you insured (list the percentage of your cropped acres in the years you participated).

____ 1989
____ 1988
____ 1987
____ 1986
____ 1985
____ 1984
____ 1983
____ 1982
____ 1981
____ 1980

2.1.4.2 (S) When you do participate in crop insurance how important are each of the following statements? Indicate the importance of each of the following factors where 1-unimportant, 2-somewhat important, 3-important, 4-very important.

____ addition of newly rented or purchased land
____ lending institution requires it for operating credit
____ soil moisture levels are low (i.e. probability of drought high)
____ to protect against risks of incorporating a new farm practice
____ to protect against the risk of seeding a new crop variety
____ pricing options offered by crop insurance
____ pest populations are high (i.e., grasshoppers, etc.)
____ other (specify)

2.1.5 (PS) What was the total premium you paid for crop insurance last year?

$____________

2.1.6 (PS) Given that the program does not change substantially from its form in the present year, do you expect to make any major changes in your use of crop insurance for the next year?

(a) yes (b) no

2.1.6.1 (PS) If you answered (a) to the above, do you plan to increase or decrease your coverage?

(a) increase (b) decrease (c) will decide in spring

2.1.6.2 (PS) Did the price options offered in the 1989 Crop Insurance program affect the acreage you allocated to any of the following crops?

Durum	(a) increase	(b) decrease	(c) no affect
Canola	(a) increase	(b) decrease	(c) no affect
Spring Wheat	(a) increase	(b) decrease	(c) no affect
Summerfallow	(a) increase	(b) decrease	(c) no affect

2.1.7 (PS) Does your participation in the crop insurance program increase the amount of land you stubble crop?

(a) yes (b) no

2.1.7.1 (PS) If yes, by how much? ________ %.

2.1.8 (PS) Please indicate if the Crop Insurance program has an influence on your decisions regarding each of the following. Answer each as follows: 1-markedly decreases, 2-moderately decreases, 3-no influence, 4-moderately increases, 5-markedly increases.

____ number of crops seeded
____ variable input use (eg. fertilizer)
____ capital investments

2.1.9 (PS) Please indicate if the Crop Insurance has an influence on your decisions regarding the fields you allocate to specific crops. Answer as follows: 1-no influence, 2-a small influence, 3-moderate influence, 4-major influence.

____ field allocation to specific crops

2.1.10 (PS) Has your participation in crop insurance affected your adoption of new farm practices, use of new inputs or the seeding of new crops? For those that it has, could you explain the effects.

new farm practices (a) yes (b) no
(e.g., minimum tillage, stubble snow trapping, airseeder, etc.)

use of new inputs (a) yes (b) no
(e.g., herbicides, etc.)

seeding of new crops (a) yes (b) no
(eg., HY-320, chickpeas, winter wheat etc.)

2.1.11 (PS) Has your participation in crop insurance affected your perception of livestock as an alternative farm enterprise?

(a) positively (b) negatively (c) no change

2.1.12 (PS) In the drought of last year did crop insurance policy influence your crop management decisions (i.e. influence your decision to work under drought stricken crops or cause you to seed more stubble)?

(a) yes (b) no

2.1.12.1 (PS) If yes, explain how you were influenced and if last year's policy had any impact on your decisions this crop year.

IF THE FARMER YOU ARE INTERVIEWING DOES NOT PARTICIPATE IN CROP INSURANCE OR IF HE IS A SELECTIVE USER OF INSURANCE THEN CONTINUE WITH THIS SECTION STARTING AT 2.2. OTHERWISE, IF HE IS A CONTINUOUS USER OF INSURANCE GO TO SECTION 3.

2.2 (NS) What is your most important reason for not participating in crop insurance? Indicate the importance of each of the following factors where 1-unimportant, 2-somewhat important, 3-important, 4-very important.

_____ premiums to high for level of coverage

_____ crop insurance is not an effective risk management tool

_____ don't like government involvement in agriculture

_____ stubble coverage relative to summerfallow coverage is too low

_____ other (specify)

2.2.1 (N) Given that the program does not change substantially from its form in the present year, do you expect to make any major changes in your use of crop insurance?

(a) yes (b) no

2.2.1.1 If yes, do you plan to participate next year?

(a) yes (b) no (c) will decide in spring

3. Specific Information on Crop Insurance

IF THE INDIVIDUAL IS PARTICIPATING IN CROP INSURANCE THIS YEAR, START AT QUESTION 3.1, OTHERWISE GO TO SECTION 3.3:

3.1 (P) There have been substantial changes in the Saskatchewan Crop Insurance program for the 1989-90 crop year. Could you specify the type of coverage you have (if any) for the three most important crops grown on your farm operation.

3.1.1 (P) Yield Coverage:

	Crop 1		Crop 2		Crop 3	
	fallow	stubble	fallow	stubble	fallow	stubble
(a) 60% of area average yield						
(b) 70% of area average yield						
(c) Individual Coverage						

3.1.2 (P) Price Coverage:

(a) floating price							
(b) fixed price	low						
	medium						
	high						

3.2 (P) Based on the current crop insurance coverage you obtain on your farm unit, what would be the maximum premium you would be willing to pay ($/acre) to continue to have the coverage (providing you are not forced to take out insurance to get operating credit)?

Crop 1		Crop 2		Crop 3		
f	s	f	s	f	s	
						$15.00/acre
						$14.00/acre
						$13.00/acre
						$12.00/acre
						$11.00/acre
						$10.00/acre
						$ 9.00/acre
						$ 8.00/acre
						$ 7.00/acre
						$ 6.50/acre
						$ 6.00/acre

Crop 1		Crop 2		Crop 3		
f	s	f	s	f	s	
						$5.50/acre
						$5.00/acre
						$4.50/acre
						$4.00/acre
						$3.50/acre
						$3.00/acre
						$2.50/acre
						$2.00/acre
						$1.50/acre
						$1.00/acre
						$0.50/acre

3.3 (E) For the 3 most important crops on your farm, could you indicate your yield expectations based on average yields across all your land seeded to a particular crop. In essence, we are interested in the range of average yields for your whole farm operation:

Lowest Estimate -- the value which will be exceeded 19 times out of 20
Highest Estimate -- the value which will be exceeded only 1 times out of 20

Crop Name	Lowest Estimate	Most Likely Estimate (bushels/acre)	Highest Estimate
3.3.1.________________			
summerfallow	________	________	________
stubble	________	________	________
3.3.2.________________			
summerfallow	________	________	________
stubble	________	________	________
3.3.3.________________			
summerfallow	________	________	________
stubble	________	________	________

3.3.4 (E) The Crop Insurance program includes a quality adjustment mechanism. Therefore indemnities are often paid for yields greater than the guaranteed production for reduced grades of various crops. Is this quality adjustment mechanism an important component in your decision to participate in crop insurance?

(a) yes (b) no

If yes, could you explain.

3.3.5 (E) As an additional feature, the Saskatchewan Crop Insurance program includes spot-loss hail coverage. Could you indicate the percent chance of hail in a given year for any individual parcel of land for the same 3 crops as above. In addition, given that you have incurred hail damage on a particular parcel, what is the average crop damage as a percent of the total crop?

Crop 1	Crop 2	Crop 3
____ % probability	____ % probability	____ % probability

(the number of years out of 10 you received hail in percentage terms)

____ % damage	____ % damage	____ % damage

IF THE INDIVIDUAL IS PARTICIPATING IN CROP INSURANCE THIS YEAR, DO NOT DO THE FOLLOWING QUESTION (3.4).

3.4 (N) Assuming that you are familiar with the program, and based on the assumption that you would be getting the maximum coverage the program offered (70% covered, high price option), at what premium rate would you consider purchasing the insurance?

Crop 1		Crop 2		Crop 3			Crop 1		Crop 2		Crop 3		
f	s	f	s	f	s		f	s	f	s	f	s	
___	___	___	___	___	___	$6.00/acre	___	___	___	___	___	___	$3.00/acre
___	___	___	___	___	___	$5.50/acre	___	___	___	___	___	___	$2.50/acre
___	___	___	___	___	___	$5.00/acre	___	___	___	___	___	___	$2.00/acre
___	___	___	___	___	___	$4.50/acre	___	___	___	___	___	___	$1.50/acre
___	___	___	___	___	___	$4.00/acre	___	___	___	___	___	___	$1.00/acre
___	___	___	___	___	___	$3.50/acre	___	___	___	___	___	___	$0.50/acre

3.5 (E) Currently, the crop insurance program is undergoing extensive review. One option which is being given a lot of thought is the possibility of insuring quarter sections as individual units. How do you feel about such a change to the program, since it will certainly result in better coverage, but with higher premiums?

(a) strongly favor (b) favor (c) neutral (d) oppose (e) strongly oppose

3.5.1 (E) The variability of yields on an individual quarter section are generally more variable then farm averages. Therefore, we would like you to indicate your yield expectations for both your most productive and least productive quarter sections on your farm for spring wheat (if you do not seed spring wheat or durum, then respond with your most important crop).

Lowest Estimate -- the value which will be exceeded 19 times out of 20
Highest Estimate -- the value which will be exceeded only 1 time out of 20

	Lowest Estimate	Most Likely Estimate (bushels/acre)	Highest Estimate
3.5.1.1 (E) Most productive quarter section			
Crop: ______________			
summerfallow	________	________	________
stubble	________	________	________
3.5.1.2 (E) Least productive quarter section			
Crop: ______________			
summerfallow	________	________	________
stubble	________	________	________

4. Farming Practices

4.1 (E) Have you broken, cleared or drained any land since 1972?

(a) yes (b) no

4.1.1 (E) If yes, approximately how many acres have you cleared or drained?

Cleared ___________ acres Drained ___________ acres

4.1.2 (E) If the cleared land was pasture, what was the grazing capacity of a 160 acre parcel?

_________ Adult Animals (plus calves)

4.1.3 (E) If yes, was this on newly purchased land?

(a) yes (b) no (c) both

4.1.4 (E) Which of the following are the reasons you cleared the land?

____ Convenience (i.e., improve field efficiency)

____ Government programs (i.e, crop insurance, WGSP, etc.)

  ____ WGTA

  ____ WGSA

  ____ Crop Insurance

  ____ CWB quota

  ____ Other

____ Grain is more profitable then any other farm enterprise

4.2 (E) Hayland program.

4.2.1 (E) Has the introduction of the new forage assistance program influenced your farm decisions about product mix (i.e. has it caused you to reconsider grain land for hay or forage)?

(a) yes (b) no

4.2.1.1 (E) With this new program in place, will you be seeding a forage in the next 5 years?

(a) yes (b) no (c) unsure

4.2.2 (E) Has the introduction of this program affected your perception of livestock (i.e. beef) as an alternative farm enterprise?

(a) positively (b) negatively (c) no affect

4.2.2.1 (E) Will you be expanding or starting a beef operation in the next 5 years as a result of this program?

(a) yes (b) no (c) unsure

4.3 (E) Given that you have made the decision to seed hard red spring wheat or durum on a particular piece of land, how much nitrogen, phosphate, sulfur, and potassium do you generally apply on stubble and summerfallow (lbs/acre) in an average production year (i.e., average spring soil moisture and average growing season)?

	Stubble	**Summerfallow**
Nitrogen	_____	_____
Phosphate	_____	_____
Sulfur	_____	_____
Potassium	_____	_____

4.3.1 (E) How much did you apply this year?

	Stubble	**Summerfallow**
Nitrogen	_____	_____
Phosphate	_____	_____
Sulfur	_____	_____
Potassium	_____	_____

4.4 (E) On average, how much do you spend ($/acre) on herbicides for a crop of wheat on stubble and wheat on fallow in an average year?

_____ Stubble _____ Summerfallow

4.5 (E) What percentage of your cultivated land base do you generally summerfallow based on your last 5 years of experience?

_____ %

4.6 (E) Do you ever use futures markets like the Winnipeg Commodity exchange or the Chicago markets to hedge your grain or livestock production?

(a) yes (b) no

4.7 (E) Do you ever use forward contracts with local elevator companies to hedge your crop production?

(a) yes (b) no

4.8 (E) How much hail insurance do you currently have excluding the coverage you have from crop insurance?

$ ______ /acre

4.9 (E) Which of the following farm conservation practices, if any, do you employ on your farm?

____ shelter belts
____ minimum tillage (reduced tillage)
____ stubble snow trapping
____ chemical fallow (no tillage)
____ cultivate with a noble blade
____ strip cropping
____ Legume in rotation
____ fall tillage
____ green manure in rotation
____ reduced tillage fallow (at least 1 chemical operation)
____ other (please specify)
____ other (please specify)

4.10 Based on the agronomics of your area, check your preferred time to seed each of the following crops.

	< May 1	May 1-15	May 15-30	June 1-20	> Jun 20
spring wheat or durum	______	______	______	______	______
barley (Bonanza)	______	______	______	______	______
canola (argentine)	______	______	______	______	______
canola (Polish)	______	______	______	______	______

4.10.1 What is the latest possible date that you would consider seeding each of the same crops?

	Date
spring wheat or durum	________
barley (Bonanza)	________
canola (argentine)	________
canola (Polish)	________

5.0 Do you have any general comments about the Saskatchwan All Risk Crop Insurance Program? Your response is open ended and can apply directly to the current program or possible changes you would like to see.

Appendix A.2

PRODUCER COMMENTS ABOUT THE SASKATCHEWAN CROP INSURANCE PROGRAM

APPENDIX A.2

PRODUCER COMMENTS ABOUT THE SASKATCHEWAN CROP INSURANCE PROGRAM

The last section of the farm survey queried producers regarding their general comments about the Saskatchewan Crop Insurance program. Producers were encouraged to relate both positive and negative experiences they had with the program. Since these responses were open ended in nature, it was difficult to perform any rigorous analysis on them. However, we were able to group together comments that were regularly made by the farmers. Therefore, the purpose of this appendix is to report and summarize these comments.

Table A2 illustrates the proportion of producers in each area who made a particular response in the final section of the survey. Based on the results it appears that the Crop insurance corporation still have to convince producers of the benefits of individual coverage, since less than 7 percent of the producers mentioned it as a possible improvement to the crop insurance program. However, it is interesting to note that individual coverage is a more popular concept in the two northern regions when compared to the two southern regions. Perhaps the 80 percent of area average yield offered as part of individual coverage seems attractive to northern producers. Particularly in light to the regional differences in program benefits attributable to the current 70 percent of area average yield approach (see Chapter V).

Another common complaint about the crop insurance program is that it does not reflect differences in land quality accurately. Not surprisingly, this comment was most prevalent in those areas where land quality is most variable. Farmers in these areas maintained that the coverage on higher quality land was subsidizing the coverage on lower quality land. Unfortunately, the empirical section of the study did not examine this issue. However, if farmer comments are accurate, then inappropriate coverage for different land quality could have substantial impacts on the use of marginal land which is treated favourably by crop insurance. This comment is also supported by producers who maintain that crop insurance encourages the cultivation of marginal land.

Two comments which are similar meaning are; (1) coverage should recognize management intensity and (2) coverage should reflect the cost of production. The first comment occurred most frequently in the Chaplin-Central Butte region, while the second comment occurred most frequently in the Melfort and Meadow Lake regions. Based on the results of Chapter V, one can understand the concern of Melfort and Meadow Lake farmers who maintained that current crop insurance did not cover their cost of production.

The most frequently stated comment from producers was that program abuse is a problem. Interestingly, the survey team received this comment more often in the two southern areas when compared to the two northern. This suggests that moral hazard may be more of problem in southern areas than northern. Based on the moral hazard section of chapter II, this seems reasonable since yield response to input use is lower in southern areas where moisture is more deficient.

Many of the producers surveyed indicated that they would prefer to have individual quarter section coverage. This is not surprising since such a change to the program would enhance coverage significantly for most farms. However, while producers were in favour of it in principle, many realized that administrating and policing individual quarter section coverage could be prohibitive.

A number of producers would prefer to see an income insurance scheme which would substitute for crop insurance and other price stabilization programs. This is not surprising when one considers that the income insurance proposals of the Grains 2000 group and the Saskatchewan Wheat Pool have received significant media attention. The numbers suggest that northern producers are more positive and informed about these proposals than are the producers in the two southern areas. Generally speaking, producers definitely perceive crop insurance as an important stabilization program. However, the level of discontent tended to increase as one moved from southern to northern areas. Many producers with substantial farming experience (10-15 years) maintain that they would have been better off with a self insurance program, even after the drought of 1988. This seems to confirm the results reported in Chapter V. However, some of these same farmers continue to participate to avoid the risk of a total crop failure. Unfortunately though, a substantial number of farmers refuse to participate or selectively participate because they perceive self insurance as a more profitable option when compared continuous participation. Premiums paid to the crop insurance corporation yield no economic return. Many farmers cannot understand how this can happen given the subsidized nature of the program. They tend to blame it on program abuse and poor administration.

Table A2: General Producer Comments about Crop Insurance

AREA	Prefers Individual Farm Coverage	Coverage does not Reflect Land Quality	Coverage Should Recognize Management Intensity	Program Abuse is a Problem	Encourages Cultivation of Marginal Land	Prefers Individual Quarter-Section Coverage	Coverage Should Reflect Cost of Production	Adjusters Should be more Consistent	Would Like to Have Income Insurance
Total	6.6%	24.0%	9.5%	25.2%	5.4%	19.4%	14.9%	6.2%	11.6%
MJaw	3.1%	16.9%	3.1%	32.3%	12.3%	29.2%	7.7%	4.6%	6.2%
Chap	1.8%	24.6%	21.1%	31.6%	5.3%	10.5%	10.5%	12.3%	12.3%
Melf	10.0%	16.7%	10.0%	20.0%	1.7%	16.7%	26.7%	1.7%	13.3%
Mead	11.7%	38.3%	5.0%	15.0%	1.7%	20.0%	13.3%	5.0%	15.0%

Source: Farm Survey.